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The Welsh Engineers' and Founders' Association
The Foundry Trades' Equipment and Supplies Association

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Planned Foundry Education

The foundry industry can count itself fortunate in possessing an educational structure founded on a broad and, generally speaking, satisfactory basis. To be of maximum value, and, moreover, to do elementary justice to foundry youth now serving with the Forces or working so hard as to preclude technical studies, the existing structure needs overhauling and co-ordinating. Normally, graduated tuition is available, starting with the junior technical schools, the technical colleges, the metallurgical departments of the modern Universities and the very specialised Foundry High School in Birmingham. The system of national examinations, so successfully sponsored by the Institute of British Foundrymen, is unquestionably excellent, as nationally-accepted diplomas of various grades and a University degree are available. It is the system of tuition which needs overhaul, and for this we think we see the key to success in the method evolved by the University of Minnesota; this method has been described by Prof. Holtby and Mr. H. F. Scobie in a Paper which is reproduced elsewhere in this issue. The courses provided at Minnesota University aim at giving tuition in *foundry control methods*, thus furnishing the industry with the very type of man of which it stands most in need, especially since such a large part of it is mechanised.

The major difference between the course of instruction at Minneapolis and at the various scholastic centres in Britain is the better appreciation of the three technical attributes required for the proper conduct of a foundry, for the technical schools are rather more out of balance than the manufacturing concerns. These three essential attributes for the proper functioning of a modern casting shop are foundry technique; engineering; and metallurgy; it is axiomatic that these three attributes should be reasonably balanced. Some foundries, like some schools, are metallurgically "top heavy," whilst with many others the mechanical equipment and supervision are still lagging behind competitive industries. There was a partial recognition of this aspect by Mr. J. G. Pearce, when he launched the Foundry High School scheme. His object was to give theoretical training to the practical and technical tuition to the academic, and he rightly expected much good to result from the close contact during the period of study between the graduates and promising works trainees. Yet by concentrating on *methods of control*, there would be a quick recognition of the deficiencies in the primary technical training for foundry executives, which could be remedied.

The knowledge now possessed by Mr. Pearce and Prof. Andrew of Sheffield University, when co-ordinated with the experiences of the industrialists, should be adequate to formulate a unified scheme for presentation to the Board of Education for proper graduation of studies from the junior technical schools upwards. The questions to be answered are as to what stage the students should be taken in chemistry, mathematics and physics to enable them with profit to study metallurgy, engineering and foundry technique so as to control that complex mechanism—a modern foundry. To the same end, the stage to be attained in engineering and metallurgy must be determined. As there are three phases to foundry control, therefore youths can be trained for any one of them. The bulk obviously will have to remain as patternmakers, moulders and coremakers, and the problem is to give every entrant to the industry, in no matter what branch, a sporting chance of becoming in later years an executive. Moreover, it should be recognised that special consideration must be given to those who, owing to *force majeure*, are unable to pursue studies at the time when the brain is most receptive. The moment the war is over, we shall return to this subject, and suggest a conference with the Board of Education, being convinced from previous experience that the Board will cordially respond to any concrete and progressive suggestions put forward by the industry. They will only demand one thing—practical co-operation.

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Metal Exchange Foundations

BY "ONLOOKER."

The London Metal Exchange is, as it were, limping along at present on a somewhat attenuated market in tin, for it has been shorn of all other activity, copper, lead and spelter no longer figuring in the daily trading. It has been hinted from time to time that tin would follow the way of the other metals, but so far all is well, and if the attendance of members is a long way from being what it was in pre-war days, the Exchange still keeps its doors open, and there is business afoot from Monday to Friday. Dealing in metals is no new thing in the City, for nearly a hundred years ago metal merchants used to gather at the Royal Exchange to talk over matters affecting their business, and from that it was a short step to buying and selling. In 1869 it was finally decided to form a Metal Exchange, and to that end rooms were rented in Lombard Street, but after the lapse of a decade this venture had so far justified itself that it was decided to secure an adequate building to house the ever-growing membership. This was erected in Whittington Avenue, adjacent to Leadenhall Market, and in that unpretentious edifice an immense volume of trading has been done in the past seventy years.

During this period of more than half a century the Exchange has, of course, had its ups and downs, and so for that matter have the metals in which dealing is carried on. During the last war trading in tin was uninterrupted throughout the whole period, but the same was not true of the other metals where restrictions were imposed, although daily prices were issued. It will be remembered, by some at any rate, that on the outbreak of war a moratorium was established, and during the first three months trading was suspended in copper, lead and spelter, although during this period quotations were issued for Best Select copper. About a month after the Armistice in 1918 normal trading was resumed, and this was continued up to the outbreak of the present war in September, 1939, when once again the axe fell. This time, however, it looks as if, with the exception of a measure of business in tin, there will be a complete cessation of market operations until the war is over. What then? It is obvious that the existing Control arrangements in metals will not be abandoned overnight, and there are those who express the fear that the return to conditions of private trading and individual enterprise will be unduly delayed. Looking forward to post-war conditions is a somewhat unprofitable pursuit, for it is impossible to evolve a coherent whole out of the many conflicting alternatives arising.

The Metal Exchange has been criticised on the ground that it is a centre for speculation, and it would of course be wrong to say that speculative transactions have not existed. The importance of this London market has not, however, been built up on anything other than sound trading, and the truth of this statement has been proved from time to time when untoward events have imposed an unexpected and onerous strain without revealing any signs of weakness. On the contrary there has been a remarkable degree of cohesion which has demonstrated beyond doubt the soundness of the principles governing the conduct of affairs in Whittington Avenue. The services normally rendered to the trade by the London Metal Exchange are many and varied, but this market is primarily a medium for hedging against holdings of ore, metal, etc., while buying of futures comes from those who wish to cover against sales made for forward delivery. There is, of course, nothing to prevent a producer delivering metal in fulfilment of his sale, and in standard copper this was a regular practice, while equally a buyer may elect to take delivery of his purchase.

Institute of Vitreous Enamellers

SOUTHERN SECTION MEETING

A meeting of the Southern Section of the Institute of Vitreous Enamellers was held at 49, Wellington Street, London, W.C.2, last Saturday, October 18, with Mr. G. H. Abbott in the chair. It was unanimously decided to revive the activities of the Section and to resume regular monthly meetings during the autumn and winter, such meetings to take the form of discussions relating to the occurrence, characteristics, properties and chemical control of the raw materials employed in the vitreous enamelling industry. First consideration is to be given to the felspathic minerals used in vitreous enamelling, and a start has been made on the collection of information on the various aspects of the mode of occurrence, world distribution, resources and production of felspars, their chemical analysis and chemical control for employment in vitreous enamelling, and the practical application of felspars in enamelling.

It is proposed that each discussion will be devoted to a report of the members carrying out the relevant surveys of existing information, and to the exchange of views and experience among attending members, as well as to the consideration of suggestions as to additional directions in which these surveys can be extended in order to enlarge their practical value to the Institute and the industry it represents. The expansion in the applications of vitreous enamelling and the problems as regards raw materials which must be faced in the post-war period appear to make such surveys, as at present planned, both imperative and desirable.

The next meeting of the Southern Section will be held at 49, Wellington Street, W.C.2, on Saturday, November 15, at 10 a.m., when a preliminary report of progress on the Felspars Survey will be discussed.

The Eighth Annual Conference of the Institute will be held on Saturday, November 1, at the Grand Hotel, Birmingham, at 2 p.m. The Conference, at which two technical Papers will be submitted for discussion, will be preceded by a Council meeting at 11 a.m.

Alaskan Nickel

During 1940 the United States Geological Survey conducted a detailed survey of the nickel deposits of Bohemia Basin and its vicinity on Yakobi Island, in south-eastern Alaska. These deposits have been known for many years, but prior to 1940 they had not been examined systematically. They are sulphide-bearing bodies that are found only in the more calcic of the younger intrusive rocks, principally in the norite. The sulphide minerals present include pyrrhotite, pentlandite, and chancopyrite.

Some of the sulphide-bearing bodies are several hundred feet in length. Eight of these bodies have been partly prospected, and at least four others are known to exist but have not been prospected. There probably are other bodies that do not outcrop at the surface. Calculations by the Geological Survey indicate that about 6,000,000 tons of rock, containing about 0.36 per cent. of nickel and 0.27 per cent. of copper, is present and available for mining in the eight bodies that have been partly prospected. The estimate of the number of tons is based on the very conservative assumption that each of the bodies extends to a depth equal to half its length. Rough calculations indicate that the material can be mined and the nickel and copper extracted from it at a cost roughly equal to the value of the metals that would be produced.

Random Shots

A "Special Correspondent" of "The Times" has been peering into one of Sheffield's electric furnaces and it is interesting to read of what he sees there. Whereas the melter, when the furnace door opens, sees only what a mess the night shift has made of the back wall, the journalist (bless him!) sees an "Arctic scene of surpassing beauty, a placid lake girt by snow-bound shores." He thrills to see the surface of this still lake being prodded into picturesque activity by slowly descending icebergs. The furnaceman, however, couldn't be expected to know of these things for he just doesn't watch the electrodes coming down. He has more respect for his eyesight!

* * *

It appears that there is even a still smaller casting made than the boot protector described recently in this column. This is a "full stop" made for those magnetic signs which were so popular before the introduction of the black-out. "Marksman" also learns that a North of England foundryman, himself a maker of boot protectors, once lost a bet to a South of England foundryman over this very question. The North Country man didn't know that his friend from the South was actually casting these "full stops" in his own foundry.

* * *

The latest idea in fabric designs comes from the States, which takes the form of chemical equations and formulæ printed all over the material.

It is felt that examination boards will prohibit the use of such dress fabrics by girl students sitting for examinations in the co-ed colleges, as this would give them an unfair advantage over the young men.

* * *

In the very modern canteen just installed in a Scottish works no effort has been spared to make both the equipment and the service attain a very high standard of efficiency. The equipment embodies the very latest ideas in large-scale catering, whilst the success of the service is largely the responsibility of the workers themselves who are represented extensively on the controlling committees. This reminds "Marksman" of a first-hand account once given him by a member of the Army of Occupation in Germany after the last war of the canteen of a large munitions works in the Ruhr. The success of that canteen depended, apparently, on the ability of the workers to eat at a uniform specified rate, for the whole system was as highly mechanised as the factory itself. The men filed in with almost military precision and seated themselves at long tables. Overhead there was an intricate system of conveyors leading to and from the kitchens. The leader of each table set the conveyor in motion, which brought along each course in turn, and woe betide the dawdler who had not finished his sausage and *Sauerkraut* in the specified number of seconds allowed by the leader before he set the conveyor on its return journey.

* * *

The crossword clue of the week comes from "The Times."

Clue: He makes a winner go (and no doubt he will!).

Answer: Norwegian.

"MARKSMAN."

PROF. E. W. H. CRUICKSHANK, addressing a meeting last week under the auspices of Aberdeen Chamber of Commerce, on the subject, "The Nutritional Needs of Heavy Workers," said communal feeding was the only way to keep the health of heavy industrial workers up to par and to maintain the industrial efficiency of the country.

Economy and Salvage in the Foundry*

AN ANALYSIS OF PRACTICAL POSSIBILITIES

By D. CARRICK

This Paper has been entitled "Economy and Salvage" because in these days they are two of the most important factors in the national programme. The full exploitation of economy and salvage is to-day essential in every phase of industry, and in the foundry and its allied departments this is necessary on account of the large quantities of raw materials used and the transport which their use involves. A careful survey of conditions and planning is required to achieve better results than normally prevail.

Probably the most important feature of foundry operation is the holding down to the lowest level the percentage of scrap castings and this invariably needs constant attention. The word economy has for one of its definitions the phrase *Careful Management*. This is a very good but wide description and it is a closer and more general meaning of the word as applied to the use of materials, labour, power, lighting and the like.

For the purposes of this Paper, salvage is the reclaiming of materials used in the foundry processes which can be achieved by re-conditioning and careful planning. The salvage of slightly defective castings is an economic factor but a subject which would be the theme for a separate Paper, and as foundrymen have mixed views on this matter it is not proposed to invite too lively a controversy.

It should be borne in mind that much of the matter to be presented will have the background of experience in mass production and mechanised foundries on cast iron. Those connected with foundries making heavy engineering and jobbing work will, it is hoped, find several points of interest.

In order to measure the amount of economy that is achieved in the use of consumable materials it is important that weekly or monthly consumption figures are available for checking and comparison. These figures have to be reliable for a stock and purchasing department to function properly in maintaining supplies, and in order to obtain these figures the accurate measurement of materials used day by day is of vital importance.

Measuring of Materials

The regular checking for accuracy of all weigh scales at the cupola and in cleaning departments is very important. Tare weights of transporting equipment and basic weights of standard products should be frequently checked to ensure errors do not creep in when computing records. All measuring equipment should be of specific unit size and kept in good condition for core sand and facing sand mixer charges. Unless this is carefully controlled it is possible for wide discrepancies to arise and not only result in a wastage of new material but in poor conditions in the final results obtained.

It is much better to use measures of a definite volume, say cubic feet in the case of sands, where the usual equipment, such as barrows, shovels or skips can vary in capacity, especially when renewals are brought into commission. The imperial measures of capacity for oil and of weight for semi-solid and powder core binders should be used. This permits easy renewal of standard measuring equipment.

Facing sand and core sand mixtures should be, wherever possible, made up in such proportions that where a part charge is required for a smaller job or small batch of cores, the items in the mixture can be readily split up in exactly the same proportions as the full charge. It is best to make sure the man responsible has the necessary auxiliary measuring equipment for this. For example, a division plate welded into the centre of the barrow, or a stout rod put through half way up a cube-foot box will save guess work. A gill measure will give the correct quantity of oil instead of roughly estimating the half contents of a tapering pint measure.

Milling time is all important in securing the best results from the mixture and to make this possible, the mill operator should be provided with a clock if the ordinary shop clock is not easily seen. A suitable board or consumption sheet should be provided to enable the mill operator to tally off the various quantities of material used.

Where additions to the bulk sand are found necessary, careful measuring and recording of the sand used should be made on a daily return. It will be found that with a continuous sand-conditioning plant a minimum quantity to maintain satisfactory conditions can be arrived at by checking the finish of the castings and by routine sand tests. Given a definite output in weight of castings an economical figure can be arrived at and adhered to for regular conditions, and instructions for a reduction or increase can be issued only when sand results or wide changes in the type of castings being produced give indications that the condition of the bulk sand is being adversely or otherwise effected.

With continuous sand-conditioning plant it is imperative that the machinery for milling, mixing and aerating are kept in first-class condition as this will prevent the need for high new-sand additions by bringing up and holding in the best condition possible the body of sand which is in circulation. It is surprising how a rapid falling off of condition takes place if one component of the machinery is working inefficiently. The adjustment of muller blades and rollers and the renewal of arms on aerating equipment must receive routine attention or renewel when necessary. Failure to attend to these very important factors with the consequent lowering of sand qualities, will soon bring on an attendant increase in scrap castings or loss of production due to bad moulds.

The infiltration into the bulk sand of core sands should be prevented where possible as a rapid loss of bond and finishing qualities will again necessitate artificial bonding materials or new-sand additions. Where this mixing of core sand cannot be entirely prevented this sand should be such that the average grain size of the moulding sand is not too adversely affected from the point of view of coarseness or equally of closing up and lowering permeability. If facing sand be required watch should be kept on operatives, especially on moulding machines, that the minimum of facing sand is used. It can become a habit to use excessive amounts where shallow work on a machine follows on deep jobs which have necessitated a reasonable depth of sand to be effective. Where the system can be used alone this should be encouraged as a saving in operations necessary to make the mould will help in increasing production.

The full removal of moulding sand from the castings at the shake out station should be insisted on with due regard to avoidance of core sand being shaken out at the same time. The adoption of the right tools for handling the hot castings will facilitate this operation. Moulding sand recovered from conveyor trenches, cleaning departments and other points where it is free from heavy contamination should be returned to the facing-sand mill for inclusion in new charges. This sand which is generally conveniently dry is very useful for lowering moisture to the correct level when new sand consignments are high in moisture content. If returned direct into the bulk sand this should be done gradually in order to give good distribution and permit thorough reconditioning and mixing by the sand equipment.

Core sand from oil-sand cores when removed from the castings can in some instances be used again where a special sand with high permeability is required. This sand must be of even grain size and sufficient natural bond must be present in the new sand with this to develop sufficient green sand strength. It may be necessary to use artificial bonding material.

The addition of coal dust in continuous systems can be a source of wastage, if this be not added in an efficient manner. It may be air-borne and carried away at points where the sand falls from grids or elevator buckets at points where a current of air is formed by heat or natural draft up elevator casings or chutes. Routine checking for the amount of coal dust in the bulk sand will help to arrive at the economical figure required for daily additions.

Weight of Gating and Runner Heads

In repetition work of especially large quantities the weight of gating should always be maintained at the minimum, and careful attention to the design of runners and sprue can, over a period, achieve considerable saving in the gross melt required. The tapering off of main gates and reduction at corners of unnecessary metal can be carried out to very good effect without loss in the efficiency of the gating. The positioning of strainer cores and size of same should be watched in order that unnecessary weight is not added.

Pouring cups can be held down to a minimum size consistent with feeding requirements, and it is always advisable to have a reasonable variety of sizes so that the best selection can be made. Different shapes can be used on which runner cups can be rammed up giving standard shapes of pouring basins with recesses to take strainer cores if required. Where a considerable tonnage is melted daily it is surprising what a small percentage saving in the weight of runners and pouring heads will total up to over a monthly basis, and the melting costs of the weight saved is an appreciable item.

It is, of course, imperative that this is not carried too far with heavy work where feeding is all important, but light and thin castings can in many instances be run with much lighter gating than is generally used. In design there is very often scope for a saving to be made in total weight without sacrificing strength. This in some cases may require more work in the pattern shop, but is obviously well worth while where large quantities are to be made. Machining allowances on small castings can in many cases be reduced without increasing tooling costs, and full collaboration between design and foundry departments on these matters should always exist.

Salvage of Spills and Surplus Metal

Where continuous melting and pouring is in operation there is considerable accumulation of metal shot or spills at the pouring stations, and surplus metal left in a ladle after pouring, in some instances, has to be pigged in order to maintain hot and fluid metal. There can be wastage if this metal is not collected in an orderly manner. In the case of spills these can be recovered by routine collection and sieving of the sand at the pouring station, thus obtaining separation of the metal for re-melt. Surplus and cold iron can be poured into chill moulds,

* Paper read before the East Anglian Section of the Institute of British Foundrymen, Mr. H. H. Shepherd presiding.

Economy in the Foundry

which can be turned over to remove the iron when set. These chill moulds should be placed in convenient positions so that both heavy and hand ladles can be completely emptied. If there is room in the foundry for several stands for these chill moulds it may eliminate the need for making up pig beds in the sand floor. Recovery of spills left on the top of the mould from the pouring operation can be the duty of the shake-out operators, who should be provided with suitable containers in which to collect this loose metal.

Recovery of loose metal from sand riddles which throw out iron or large pieces of core and hard sand can be facilitated by the installation of a sorting grid from which metal can be picked out and the remaining material placed in separate containers for removal. The metal delivered from the magnetic separator is worthy of attention as sprigs, chaplets and small castings which have gone through the shake-out grids can be recovered at this point. Some foundries with a large output find it economical to use a separator which will take the cupola drop, skimmings and waste sand mixed with spills and wash out the unwanted material, separate the coke, and give a resultant clean iron shot for return to the cupola. Separators of this type have been encountered which are of the round tumbling-barrel type, with a constant flow of water through them which washes out the dirt and floats off the coke through a large hollow trunnion bearing. The author is not in a position to state whether these were thoroughly economical as the power consumption for driving and pumping the water must have been considerable. They did, however, save labour in sorting where large quantities of material had to be handled. It is always of interest to keep an eye on the rubbish tip which will soon give evidence of wastage if this is occuring.

Chaplets, etc.

It is always a good point to see that moulders are provided with partitioned boxes for these and any other small accessories in order that they are not spilled around and wasted through being lost in the sand. It is also better to issue small quantities of these commodities to avoid surplus requirements being left over at the end of the run.

Paraffin

Where this is used for keeping patterns clean it is desirable that a daily issue of the minimum quantity is made to the machine operators and a hard and fast rule that this quantity must be made to last for the day's run. Spray guns for spraying moulds or patterns should be of a type which does not atomise the fluids used too finely, or much of the liquid blows clear of the surface to be treated.

Tools, Equipment and Protective Clothing

Items under this heading can be a very heavy expense and the stores tickets for same should be only issued after full investigation is made as to the real necessity for replacement. It is a good plan to have the departmental shop clerk keep a record of all issues to individual employees to enable a check to be made for misuse.

Salvage of Core Sand

Scrap cores in the core department and returns from the foundry can be ground up and the sand used to a certain percentage, in standard core mixtures. Where large productions of one type of core is in progress it is better to retain the particular scrap cores of this type for use in the standard mix, when a reduction in permeability will be avoided by keeping the same grades of sand together. This recovered sand can be used entirely with additional core binder for certain classes of lower grade work. This recovered core sand will serve a useful purpose in giving added green bond to an oil-sand mix and where used in metal coreboxes will give cleaner working. Core benches must be so constructed that there is a minimum spillage of core sand in the core-making operation.

Economy in Labour

In considering the efficiency of the labour in the foundry and its allied departments it is always helpful to keep a summary of the personnel grouped in the various categories of core makers, moulders, machine moulders, general labourers, etc. Details of the different duties these various employees can perform should be listed and these will give a lead when re-arrangement of labour is necessary. It is possible by this means to see how the various grades of labour balance out in proportion to each other.

The efficient utilisation of labour is not always possible on certain work because one or more members of a team may have less work to do than the others when synchronisation and allocation of various duties cannot be fully balanced. By deeper study of the complete cycle of operations and a re-allocation of certain duties better balancing can be brought about with a reduction in the total man-minutes required to complete the cycle. In some instances it will be found profitable to increase or decrease the number of men in a team in order to obtain the most economical output per man-hour; this, of course, can be achieved with the co-operation of the time and motion study men. Where the services of the latter are not available the use of a stop-watch by the foundry executive will show where the re-balancing is necessary.

The overhead costs of the moulding machine or production unit should be controlled, as the overhead cost per piece could offset the saving in direct labour costs if a reduction in labour reduces the output too heavily. Where long runs occur, the labour on subsequent work following the actual moulding operation should be laid out to keep pace with the maximum output of the machine operators.

The general labour in a mechanised foundry can be an overburden if the duties of the various men are not carefully studied and checked to see that full utilisation of their time is made. Bonus systems of payment for some of the duties of general labourers can be made, thereby giving an incentive to the men for efficient utilisation of their time. In this way, man-hours can be saved and an increase in the overall efficiency of the department also obtained. Jobs, which in the average foundry are considered as day work, can in some instances be covered by use of the principle referred to.

It should always be arranged that a team or individual men are instructed to maintain their particular section of the foundry in good order as this will save the detailing of other labour for clearing up floor space or removing light equipment.

Where continuous conveyors for moulds are not installed for work coming off moulding machines, simple additional equipment can be provided that will eliminate certain operations and improve the output. For instance, simple types of metal bottom-plates can be made to suit medium-sized flasks which will obviate the need for bedding down on the sand floor. These plates can be quickly set at an angle for a sloping mould and their cost will soon be covered by the saving in time spent in cutting up and preparing the sand on which the moulds are normally placed. Short pieces of roller track will provide a means of moving medium-sized work away from the machine and form a convenient stand on which finishing and core-setting work can be done more easily. There are many other items which could be included here which would eliminate some of the labour in finishing and handling all sizes of moulds, particularly those produced on repetition lines. Multiple mounting of patterns and multiple core equipment should be fully exploited with due regard to the quantities to be produced, and the cost of the extra patterns and mounting. Another source of economy in foundry labour can be made by very careful attention to pattern conditions. In many instances slight repairs to a damaged pattern or a small increase in draft will save considerable time on the part of the moulder in repairing a damaged mould.

Careful pattern inspection before initial runs and regular inspection of patterns before being sent out for consequental runs will ensure that small repairs are carried out before patterns are issued to foundry. Where small and medium sized semi-repetition jobs are issued to hand moulders time can be saved if a runner and gates are provided for ramming up with the pattern. This will save the moulders' time in cutting the gates and will give regular conditions when pouring the castings. Small odd jobs can be rammed up and with other work where the space in the flask permits this.

It should be noted that the handling and movement of materials in the foundry and its allied departments is one of the biggest items involving labour, and any step that will facilitate or reduce the handlings of materials in the various stages of production will help to bring about a saving in labour costs. It is essential to ensure that materials are stored as near as possible to the position where they are used. Always insist that men have the proper equipment for doing their work with the maximum of efficiency, as for example: The correct size of barrow for the material to be handled; the correct size of sieve that the work warrants the correct size of rammer head relative to the type of job and flask, and the correct size and depth of flask.

Economy in Power, Lighting, etc.

These items in any foundry, but especially in a mechanised plant, represent an important factor in the running costs. They should be carefully controlled, and the following remarks will give instances where some economy can be made.

Compressed air next to electricity is a most important means of power, and its wide use involves heavy power costs in many foundries. Its use for hoists, machine operation, blow pipes and pneumatic rammers can bring about a source of loss if the numerous small air leaks which develop on this kind of equipment are not immediately rectified. A systematic method of reporting air leaks in conjunction with immediate service from a maintenance department is essential to avoid wastage. The sum total of many small air leaks will represent quite a substantial power factor, and it should be remembered that this loss continues throughout all operating hours and in some instances outside these hours also.

Where air-hoists are installed their capacity should not be greatly above the loads to be carried, as the same volume of air is used whether a light or heavy load is being carried. When the stroke of a standard joist is more than is required for a repeated specific operation, this should be shortened up by distance pieces fitted in the cylinder to avoid wastage of air. The type of nozzles used on blow pipes is another instance where wastage of air can creep in. The design of these nozzles or pistol valves should be studied as the use of a fully efficient type will prove its worth. There is a type on the market which has an outlet smaller than the average, and the small stream of air acts on the injector principle and draws more air from openings at the side of the nozzle. This type of valve and nozzle will be found more beneficial for blowing off open moulds without damaging corners. Indiscriminate use of blow pipes and vibrators should be looked out for.

Economy in the Foundry

Lighting

In these days of black-out precautions lighting costs, of necessity, are much heavier than in normal times. Very few foundries have a high standard of lighting, as general conditions do not lend themselves to this end, and it is not suggested here that economy should be sought by reducing still lower these standards but rather that improved lighting can be achieved without increase in the power consumption. It has been proved time and time again that where lighting standards are raised there is usually subsequent increase in the efficiency of the workers and the quality of the work they produce. New types of lamps are available to-day which give up to three times the lighting efficiency of ordinary tungsten filament lamps of the same wattage. Although these lamps are more expensive in the initial outlay they have a longer life, and their installation is recommended where an improved system of lighting is under consideration.

Due to overhead cranes, general lighting from the side walls or at a fairly good height have in some cases to suffice. Where this does not apply a lowering of shades and a system of local lighting at machines and coring stations is to be recommended with individual switches installed to permit cut off when not required. Lamps with lower wattage for this local lighting will thereby suffice and give better service. It often occurs that several lights have to be kept on when only one or two are actually required, and this condition should be altered where re-wiring can be justified by the saving to be made. An individual should be detailed to switch off all unrequired lights at the end of production hours, or at any other time when this is possible.

It will, of course, be realised that many other factors relating to the subject could have been included, but these can, of course, be raised in discussion. Whilst the points raised in this Paper are no doubt obvious to keen foundry executives, it should be realised that the measure of economy achieved will depend on the strength of the action taken to bring about and hold the necessary changes involved.

DISCUSSION

Mr. H. H. Shepherd said the Paper was interesting and unique in so far as he knew no similar Paper had been presented before any of the Institute's Branches recently. In response to Mr. Carrick's remark that economy in refractories had not been brought out in the Paper, Mr. Shepherd said that this could easily form the subject of another Paper. Time allowed mention of one or two points only. An important saving could be made by exercising more care in the use of ganister, much of which was wasted around the cupola in almost all foundries through inefficiency. He considered also that firebricks were often used too lavishly. Scrapped crucibles, particularly of the graphitic type, and pieces of old grinding wheel (not bakelite bonded) were very useful for cupola patching, and saved firebricks. Excessive amounts of raw materials were consumed as a result of careless weighing of charges or because weighing machines were not kept in good order. Where sand reclaimed from oil-sand core was too much for use in the moulding sand it could be utilised to advantage for the production of strainer cores.

Mr. A. Campion (Scottish Branch) said economy should not be taken to mean the use of something sixpence cheaper irrespective of quality. He advocated a spotter system of control of every foundry operation coupled with the keeping of proper records in a form that anyone needing to consult them could understand.

Mr. A. Hammond remarked that most of the points dealt with were very well known but not always practised. The question of non-productive labour interested him and he asked the author the proportion of productive to non-productive labour in a mechanised foundry. He agreed, too, that excessive use of facing sand was a common fault as well as very costly.

Mr. C. H. Kain was of opinion that the majority of foundries do not keep ample records, with the result that the same remedies are tried repeatedly at intervals. Maintenance of plant in good order was another important consideration upon which the author had insufficiently stressed. What he had in mind was the keeping of plant running as against its reconditioning after breakdown and stoppage had already occurred. Wasted hours caused by breakdowns, if properly recorded, would, he thought, astonish managers. Compressed air was a very expensive form of power and a serious amount of money was lost due to air leakages. Respecting non-productive labour, Mr. Kain said the ratio to the moulding hours varied from 100 per cent. for machine moulding to 300 per cent. for jobbing or floor moulding. Adequate lighting was a very important point especially now that daylight was so restricted. The new sodium and mercury vapour lamps were a great improvement over the old tungsten filament type, with a reduction of watts consumed. In some foundries a number of men were employed continuously in sweeping down and whitening the foundry walls. Regarding the keeping of records Mr. Kain stressed that he did not mean records of casting methods solely, but included those relating to the materials consumed per ton of castings made.

Mr. R. Campbell considered that it was important to have a proper check upon all scrapped castings, by some foundry authority, to ensure that the fault really justified scrapping and to ascertain the actual cause of the trouble.

Mr. J. L. Francis, commenting on the keeping of foundry records, agreed that much more could be done in this direction in most foundries. He thought particular importance attached to the recording of methods and devices used to overcome difficulties where castings had proved troublesome to manufacture. With regard to excessive use of charged materials due to careless or incorrect weighing, to keep an accurate check on this it was essential that the weighing-in of materials on receipt at the works must also be correctly and carefully performed. He congratulated Mr. Carrick for his valuable and topical Paper.

Author's Reply

Mr. Carrick, replying to the points raised, said the question of non-productive labour must be considered, bearing in mind the type of product as to the balance of non-productive hours against tonnage. Generally speaking, he found that the non-productive labour hours balanced with the actual moulding hours in his plant, which was mechanised. He thought the difficulty of obtaining good maintenance fitters in a mechanised foundry was largely because of the uncongenial nature of the conditions of work and also because much of it had to be done at week-ends. Records of non-productive time due to plant failures were kept and analysed so that the executives concerned could be notified. The keeping of good records of gating changes, together with the other points mentioned, was not easy but well repaid any trouble taken to do so.

Mr. H. H. Shepherd referred to the point, mentioned in the Paper, of the rejection of facing sand because it had become dry. This was important in that much sand so wasted needed only to be retempered to render it quite fit for use again.

Finally, a vote of thanks to the author was moved by Mr. A. Campion and seconded by Mr. A. Hammond.

Catalogues Received

Paints. A decorative six-page pamphlet received from Wailes Dove Bitumastic, Limited, describes, making lavish use of colour, the potentialities of their products for both internal decoration and outside protection.

Electrodes. In leaflet No. M21, Murex Welding Processes, Limited, Waltham Cross, Herts, detail the properties of "Nicrex"—a recently developed high nickel-chrome alloy electrode. It is stated to possess good corrosion and heat-resisting properties. Owing to its higher electrical resistance, the current values for the different gauges must be closely adhered to.

Laboratory Apparatus. An extremely interesting and important leaflet has been sent to us by Griffin & Tatlock, Limited, of Kemble Street, London, W.C.2, and elsewhere. It details an electrochemical apparatus for the rapid gravimetric estimation of the constitutions of a number of mainly non-ferrous alloys. Two types are available, a five-unit set for large-scale use, and a single-unit set for laboratories requiring a smaller output. Great attention has been paid to the inhibition of corrosion by the incorporation of special glass, vitreous enamel and other resistant materials.

Magnetic Machinery. The Rapid Magnetting Machine Company, Limited, 183, Moseley Street, Birmingham, 12, in their new catalogue have very largely relied on illustrations to carry the story. Nevertheless, the captions are in many cases sufficiently descriptive to arouse interest in the particular machines. The ground covered includes much of interest to the foundry industry, and no executive can neglect keeping himself up to date in connection with lifting magnets, separators, chucks and clutches. This catalogue, which is a distinctly valuable addition to trade literature, is available to our readers on request so long as the supply lasts.

Alloy Briquettes. A four-page leaflet received from F. & M. Supplies, Limited, 21-23, Coldharbour, London, E.14, discusses the question of alloy briquettes for making additions of silicon, manganese and chromium to cast iron. Each type of briquette has wisely been made of a differing shape. The use of briquettes is becoming quite a feature, not only in iron, but also in steel practice. The advantages accruing are well set out in the leaflet, not the least of which is the elimination of weighing. The briquettes, except the chromium type, are available in two sizes. For cupola operation there are included two tables, which reduce calculation to a minimum. The leaflet is available to readers on application to the issuing firm.

"Marlox" Coating Material

"Marlox," a plastic coating for metals, is announced by Marley Chemical Company, of Detroit. A plastic coating of the structural type, it is used either as a priming coat, or purely for protection against rust and corrosion. The coating is said to have very little porosity. It is successfully applied by spraying, painting or dipping, forming a thin flexible coating. When used as a base coat, it provides a tough, durable bond between metal surface and any kind of finishing coat. To inhibit rust and corrosion, it is applied to a thickness of ½ of 1/10,000-in. When used as a priming coat, it is applied to a thickness of 5/10,000 in. Tests by automotive manufacturers showed complete protection of Marlox-coated metal kept in a humidity chamber for six months, with average relative humidity of 98.5, at a temperature of 94 deg. A similarly coated panel was subjected to a salt spray test for 600 hrs. with satisfactory results. The product dries quickly and can be handled in 5 to 10 mins. after applying. It can be applied to all types of metals and alloys including steel, cast iron, aluminium, aluminium alloys, magnesium alloys, copper and brass.

Electric Smelting of Iron Ore

EVOLUTION AND ECONOMICS OF THE PROCESS

Dealing with the evolution of the process of smelting iron ores by means of electric power and the economic considerations determining the practical application of the process, E. DARRER, in an article in "Elektrotechnische Zeitschrift," points out that since in the electric smelting furnace that portion of coke in the charge, which, by combustion, generates heat in the standard blast furnace, is replaced by electric heat, and no air has to be blown into the furnace for the combustion of the coke—the coke in the electric furnace being utilised solely for reduction, carburisation and attenuation of the charge—the lines of the standard coke blast furnace were at first only slightly modified in an attempt to utilise electrical energy for smelting iron ores and for the manufacture of the more common ferro-alloys. The principal change made was the substitution of the tuyeres by electrodes, which were passed through an arched-roof hearth. Developments on these lines were centred mainly in Sweden, where electric power was more readily available than metallurgical coke, and where the Gronwall electric furnace has been used commercially for some years.

It was soon found, however, that simple adaptations of existing designs of blast furnaces suffered from various technical disabilities, such that a complete departure from the lines of the standard coke furnace became imperative. As a result the height of the furnace was much reduced; although this showed some improvement in smelting conditions, the results obtained were not entirely satisfactory, for the furnace gases were still allowed to escape and much heat was lost in consequence. Eventually a roof was provided and the reaction gases were collected, which considerably cut down the heat losses. Other improvements were gradually introduced, and the electric smelting furnace finally became a practical proposition. It would lead too far to notice this evolution, even in brief detail. It must suffice to note that eventually standard designs were evolved, of which the principal are the modern furnaces of Tysland-Hole and Siemens; some practical details of these furnaces are given below.

Modern Types of Furnaces

In modern examples of those furnaces which have been more or less adapted from the standard coke blast furnace, charging is performed on much the same lines as in the latter. Some have six electrodes fed from three single-phase transformers with primaries in delta, and pairs of electrodes on the secondary side paralleled with one phase. In 8-electrode furnaces, conversion is by means of two twin single-phase transformers in Scott circuit, four circuits being obtained on the secondary side, each with two electrodes in parallel. The voltage on the secondary side, *e.g.*, may be made variable in eight steps from 60 to 120 volts. The power consumption of these modern 8-electrode furnaces is about 6,500 kw., and they smelt about 65 tons of rich ore per 24 hrs., with a consumption of 2,400 kw.-hrs. per ton or 3.4 tons per kw.-year. These values are, of course, entirely dependent on the working conditions, the quality of the pig-iron made, and the type of coal and ore used. The lowest consumption figure of 2,000 kw.-hrs. per ton is obtained with "chemically cold iron," rich ore and charcoal.

In these furnaces, charcoal is mainly used for reduction, consumption being only 40 per cent. that in an ordinary blast furnace. If coke alone were used, the C content of the charge would be too small to produce caking; adequate caking is obtained with the specifically-lighter charcoal. The coke should therefore not exceed 40 per cent. of the total carbon, although the use of charcoal is an economic disadvantage. The electrode consumption forms an additional 6 to 8 kg. per ton. The gas yield is 800 cub. m. per ton with a calorific value of 2,300 cals. per cub. m. It is recirculated with 1,600 cub. m. per ton of fresh gas, making a total of 2,400 cub. m. per ton, *i.e.*, about half the volume required in a standard coke blast furnace. Comparative analyses of the gas from the electric smelting furnace and standard coke furnace are as follow: CO_2, 15 to 30 and 10 to 16 per cent. respectively; CO, 55 to 70 and 25 to 30 per cent.; H_2, 8 to 12 and 0.5 to 4 per cent.; CH_4, 0.5 to 2 and 0.5 to 3 per cent.; N_2, 0.5 to 2 and 52 to 60 per cent. respectively. Over most of the stack height, the temperature in the electric smelting furnace is lower than in the coke blast furnace.

Tysland-Hole Furnace

The Norwegian electric-smelting furnace (or Tysland-Hole, Spigerverk or Oslo furnace, since it was originally designed by G. Tysland, improved by I. Hole, and later developed by Christiania Spigerverk A.S., Oslo) is only a few metres high and consists mainly of a roofed hearth, through the top of which the electrodes are passed. Different arrangements of electrodes and charging holes have been introduced for specific purposes. In these furnaces, the charge does not press so heavily against the electrodes as in the earlier furnaces, enabling the electrodes to be passed deeper into the charge and the furnace to be run at higher voltages, which is especially useful when using coke. As the furnace is so squat, coke or other cheap fuel can be used, the greater amount of sulphur so introduced not being a disadvantage, for desulphurising action is very good owing to the high temperature; in fact, a very low sulphur iron can be produced in these furnaces. The charges also require less preparation than with an ordinary coke furnace and a higher proportion of fines can be used. The slag is very hot and can be kept very basic. Temperature and composition control are reasonably simple.

The reduction of the oxides is mainly direct as in the former electric types, so that the furnace gases have the high calorific value of 2,600 cals. per cub. m. The gas yield is about 650 cub. m. per ton of iron, but again is closely determined by the working conditions, and particularly by the type of ore used. The gas leaves the furnace at a temperature of about 250 deg., its pressure being controlled to reduce losses to those unavoidable through the charge holes. Hole gives an average analysis of a gas of 2,570 cals. per cub. m. as 15 per cent. CO_2, 78 per cent. CO, 1 per cent. CH_4, 5 per cent. H_2, and N_2 (by difference) 1 per cent. Compared with the adapted electric-smelting furnace, the CO is higher and the CO_2 is hence lower. The coke consumption depends on the nature of the coke, the ore and the pig produced, an average being up to 420 kg. per ton of iron. Electrode consumption is about 8 to 10 kg. per ton, which can be reduced by using wood charcoal in place of coke.

This particular construction of furnace enables a high p.d. to be applied to the electrodes, *viz.*, over 170 volts. The power consumption is 2,300 to 2,600 kw.-hrs. per ton, *i.e.*, higher than with the previous furnace. A characteristic output is 400 tons per week. The largest furnace yet built is rated for 10,000 kw., representing an output of 100 tons of pig-iron per 24 hrs. with rich ore.

Siemens have also designed an electric furnace on the lines of the Tysland-Hole, but this has a removable roof in place of a fixed roof. One of these furnaces has been installed at Aosta, in Italy; with a rating of 12,000 k.v.a., it smelts 50 per cent. ore with a power consumption of 2,000 to 2,600 kw.-hrs. per ton.

Economics the Main Criterion

While from the metallurgical standpoint, smelting in the electric furnace has a number of outstanding advantages, such as the absence of a blast and of a nitrogen ballast and the ability to use low-grade ores and coke, the process has the decisive disabilities of being commercially uneconomic and of being hence unable to compete successfully with the coke blast furnace. The nature of the reduction processes in the two classes of furnace is the same, the reducing agent being carbon in both cases. Less than half the oxygen in the ore is removed by direct reduction in the blast furnace, but practically the whole is eliminated in this manner in the electric smelting furnace, where the oxygen from the ore is the only fuel available for combustion of the carbon. In the coke furnace additional oxygen is introduced by the blast.

According to Darrer, one ton of iron is obtained from 1,430 kg. of Fe_2O_3, or 1,380 kg. of Fe_3O_4, so that about 400 kg. of oxygen must be removed by reduction for each ton of pig-iron. In direct reduction as in the electric furnace, 300 kg. of carbon, *i.e.*, 350 kg. of coke, are required for this purpose. To carburise the pig to 3 to 4 per cent., another 30 to 40 kg. of carbon is needed per ton, *i.e.*, 50 kg. of coke. The total coke required in the electric furnace is thus 400 kg. per ton, and in the coke blast furnace 1,000 kg. per ton, the difference of 600 kg. of coke being equatable against the 2,500 kw.-hrs. consumed in the electric furnace.

The 400 kg. of coke used per ton of pig-iron furnishes 650 cub. m. of gas, with a total calorific value of 1.7 10^6 cals., equivalent to 240 kg. of coke, so that half of the sensible heat of the coke passes into the gas. Applying a similar analysis to the coke furnace, the actual net consumption of 160 kg. of coke per ton in the electric furnace is found to correspond to an actual consumption of 500 kg. of coke in the coke furnace, to which must be added 100 kg. of coke per ton representing the heat from the stack gases used to heat the blast, *i.e.*, a total of 600 kg. of coke.

Energy Balance

The energy balance is thus reduced to 400 kg. of coke per ton in the coke furnace to 2,500 kw.-hrs. per ton in the electric furnace. Assuming that the by-products and other factors common to the two furnaces can be equated financially, it is clear that the economic possibilities of the two processes depend on the comparative costs of these quantities of the two forms of energy. Economic equivalence is obtained if the cost of coke per kg. is roughly six times that of 1 kw.-hr., while if the other advantages of the electric smelting furnace are also taken into consideration an equivalence may be assumed with a ratio of 1:5.

A comparison along similar lines can also be made on thermal considerations on the basis that the calorific value of 1 kg. of coke corresponds to about 8 kw.-hrs., making the equivalence ratio 8:1 or including additional advantages 6:1. These figures assume that electricity is hydro-generated and not steam-generated, steam generators having such a low thermal efficiency that four-fifths of the calorific value of the coal does not reappear as electrical energy. The ratio of 6:1 is rarely satisfied, and limits the use of the electric smelting furnace to those few areas where cheap hydro-electric power is available, hence the utilisation of these furnaces in Scandinavia.

Intricate Joints

By JAS. TIMBRELL

Much of a skilled moulder's productive time spent in the making of awkwardly shaped castings goes in trimming the joint, where this necessitates stepping to ensure a true half joint line. With small quantity orders of a semi-jobbing kind, a sand "oddside" is usually standard procedure.

Occasionally the moulding boxes available are not always the most suitable, so careful "lifter-ing" and ramming up is essential, if a clean lift be ensured.

For standard production castings, "plaster sides" or cast pattern plates, and template production by the removal of "oddsides" and jointing problems; in addition, patterns so mounted permit the use of semi-skilled moulders. The method is applicable to almost any type of pattern, and is limited only by size and the facilities available for handling.

In several cases the method has been used to replace dried moulds, the cover core having all the advantages of a dried top, where such is necessary for safe chapletting to anchor jacket or other cores. For the purpose of easy description a "two-parted" solid pattern, with loose pull-in flanges, has been chosen.

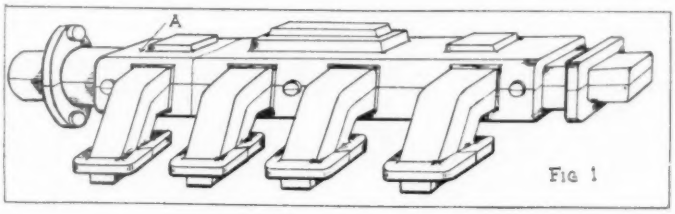

FIG 1

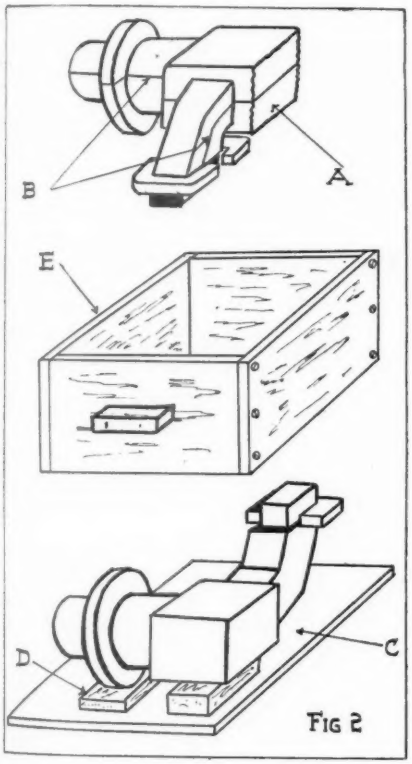

FIG 2

interchangeable moulding boxes, with shaped box bars to "mate," have advantages and simplify quicker production. This last combination permits the use of lesser experienced labour. There are many types of patterns worked loose, for various reasons, very often on account of the quantity of new tackle necessary to fit out the unit, suitable for semi-skilled production; moreover, many designs do not lend themselves to "splitting" on a level plane, which would render them acceptable for plate moulding. Solid patterns are sometimes necessary for reasons of strength and rigidity. The uses of cores here and there will, on occasion, make a pattern stronger and easier to mould, finish and core-up.

With these limitations in view, the following system is described as a means of increasing

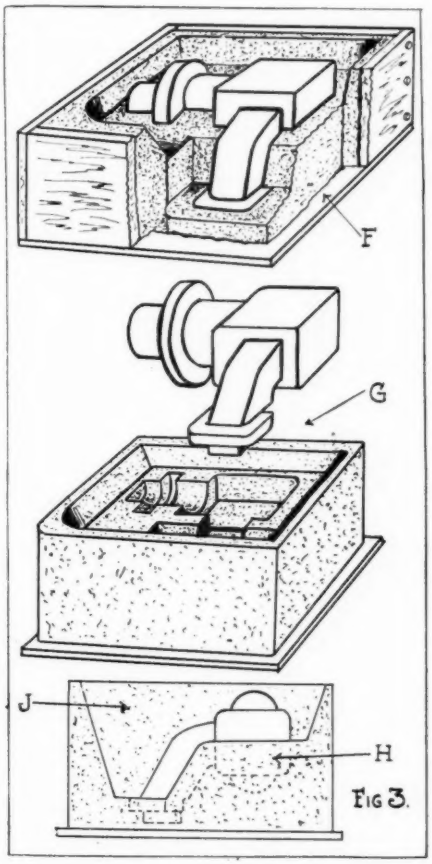

FIG 3.

Fig. 1 shows the solid pattern for a 4-cylinder water-cooled exhaust pipe, previously worked "loose" from a sand oddside. To simplify the drawing, and to save space the end piece A, Fig. 1, is taken to illustrate the process, and for converting this steep-jointed job into a flat back. The description and method as applied to this particular piece of pattern are the same for whatever the style of pattern. The joint line is shown at B, Fig. 2. The pattern is set up square on a dead level plate, to make for a true strip, shown at C; the thickness of the cover print at the highest point is controlled by the thickness of the packing piece D, placed under the highest point on the pattern, which becomes the top during the subsequent pouring. Other packing pieces are added underneath at suitable places to set the pattern level. A check over with the set square and scribing block is advisable.

A length of pig-iron or other suitable weight is placed on the pattern; when this is in true position, to make sure there is no disturbance during the first course or so of ramming, the weights are, of course, removed when the pattern is so far rammed up and secure against movement. A wood box E is made (screwed together) and squared up, and incidentally generous moulding space should be allowed round the pattern inside this box. Box E is placed over the pattern, and the ramming up done in a toughish, air-drying, easily-tooled sea sand, such as used for coremaking; it is rammed hard and strickled-off level.

Fig. 3, F, shows a cut-away view of the pattern in the mould, after jointing and prior to the withdrawing of the pattern from the mould. Incidentally, at this juncture, the means of running the castings proper should be considered. The width of print necessary to accommodate the runners allowed for, these runners (or gates) are, of course, fitted on to the finished block print later. G shows the mould with the pattern drawn out and the wood

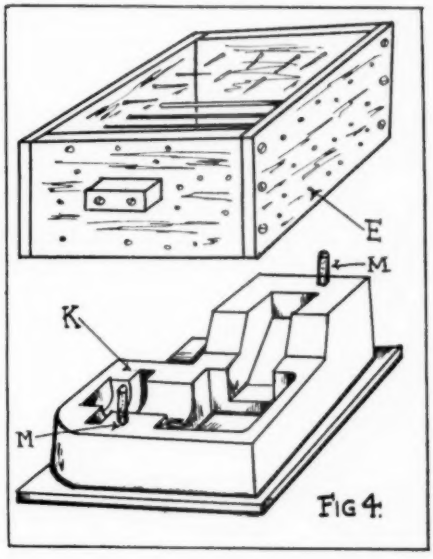

FIG 4.

frame removed (after unscrewing), the mould is then dried out in the core stove.

After drying and cooling off, the pattern is put back into the mould, any high spots or tight places should be trimmed away with fine emery cloth to make sure that the pattern "beds down" properly at all points. The pattern is left in the mould as shown in section at H, and the inside surface area of the mould face (as it now is) is painted with hot molten beeswax to ensure a smooth face and to render the block waterproof during the subsequent operations. After the coating of beeswax has set, all surplus "blobs," etc., are smoothed off, and the inside area as well as the pattern is given a coating of thick warm oil and a dusting of fine parting powder.

For casting the block, the hard setting stone-like materials are excellent, and plaster of paris is suitable if the pattern is likely to be worked with reasonable care. Space J is filled in with this material, and strickled off level with the face. After the material has set hard, the mould and the block are separated; the block shown at K, Fig. 4, is cleaned up with methylated spirit or paraffin, and generally polished up all over. The pattern is taken out of the block and the entire block surface is

Intricate Joints

recoated with oil and a dust of parting powder.

The block is then placed on a level plate, and the wood box E is prepared to receive a cast of the same material as used for making the block; rods may be fixed and nails driven in, in places, to secure the inside during its subsequent use as a corebox.

After this coat has set, the block print and the corebox are separated, and warming usually facilitates an easy strip. On biggish jobs it is helpful to place two or three cores at suitable points, M. These will permit of the block being pushed out with suitable short rods. Incidentally, clearing these cored holes will relieve any vacuum created by the oil coating and close contact of the two faces.

The corebox and the cover-core block are cleaned up and painted in the usual way and the runners added in their appropriate places. Fig. 5 shows the finished block and full pattern, fixed to a "double-handed" pattern plate. The full corebox is also shown in Fig. 5. For Sandslinger, jar ram, or other methods of mechanical production of these flat-back moulds, metal patterns in either cast iron or pattern metal, instead of the hard-setting or stonelike plaster of paris materials, are recommended, and can be

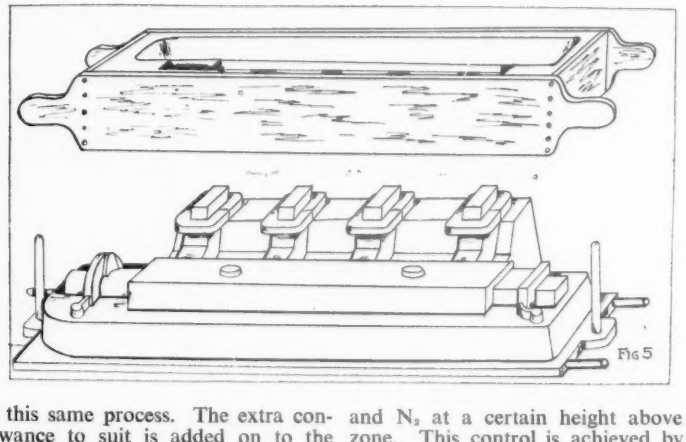

Fig 5

produced by this same process. The extra contraction allowance to suit is added on to the master pattern in the first place, Fig. 1.

The cycle of operation is carried out in the same way as far as Fig. 3. The block F, Fig. 4, is used as the pattern, the back is lightened out with another of the block cores K, produced from the master mould G. This second block core is pared down all over to give ¼ in. or ⅜ in. thickness section, when placed in position behind yet on the mould made from the block pattern K. This, of course, is moulded with the master pattern in place in the block for cast iron.

If non-contracting pattern metal is used, the master pattern is left out of the block and refitted into the cast metal print after this is filed up to suit. If the corebox is to be cast in metal, it must be cast in the same material as the block print. The core G, Fig. 3, is trimmed away all over the back and sides to a suitable section and used as the pattern to mould from, after the usual beeswax treatment. Handles and levelling bars are placed at suitable points during the moulding of this corebox.

Technical Bulletins on Aluminium

To serve the needs of aircraft and other defence industries using aluminium, the Aluminum Company of America is publishing a series of technical information bulletins showing the most recent developments of their technical departments. Bulletin No. 1, just issued, lists 100 references on aluminium of special interest to manufacturers of defence materials, covering metallurgical aspects of aluminium as well as its application in a variety of industries.

A University Course in Foundry Control Methods

(*Concluded from p. 273.*)

the students analyse iron and steel for carbon, silicon, manganese, sulphur, and phosphorus content; coke for moisture, ash, volatile combustible matter, fixed carbon, and sulphur content; limestone for ignition loss, silica, "combined oxides," calcium oxide, magnesium oxide, and carbon dioxide; and sand for moisture, clay-content, and fineness.

Control of processing materials involves the testing of moulding sand for moisture content, effect of moisture, clay content, bond strength, fineness, and permeability. The testing and grading of the foundry sands are carried out according to the methods prescribed by the American Foundrymen's Association.

Cupola Study

Operation by the students of a 15-in. cupola is one example of scientific control of a foundry manufacturing process. This cupola was designed and built in the university foundry. It is equipped for maximum control during operation. Sized coke and metals of uniform composition are weighed accurately. Combustion is automatically controlled to maintain predetermined relative quantities of CO_2, CO, and N_2 at a certain height above the melting zone. This control is achieved by means of a device which automatically samples and analyses the stack gases every 2 min., readjusting the blast gate when the quantities change. Both pressure and volume of the incoming air are measured and recorded. A gas-heated, silica-gel, dehumidifier dries the air for the blast.

The exact desired humidity is obtained by mixing dry and moist air in a suitable arrangement of ducts, and checked by means of wet and dry junction thermocouples located at the blower intake duct. A definite tapping sequence is maintained by stop-watch timing. The temperatures of the metal at the spout and at the mould are rapidly and accurately measured with a tungsten-graphite thermocouple perfected in the foundry department.

Testing and Calibration Work

Another example of process control is illustrated in the methods used to make a test-bar mould. Moulds for test specimens poured in green sand are machine-made from synthetic sand No. 10. This sand is prepared by rebonding the dry sand with bentonite and gelatinised starch, and mixing with water in a muller. The moulds are jolted a definite number of times and squeezed at a specific pressure. Similar control is studied in the non-ferrous melting and sand-mixing departments, and in the core room.

Equipment such as pyrometers, pressure gauges, weighing scales, and flue analyser are calibrated periodically by the students under supervision. For example, thermocouples are calibrated by immersing in a small crucible of metal held in a silicon-carbide tube furnace. The temperature of the molten metal is determined by a noble metal couple which has been checked against primary standards.

The students study causes of casting defects in the control laboratory. X-ray and gamma-ray examinations are made of pressure castings. Rapid routine methods of analysis are used to determine the carbon, silicon, manganese, sulphur, phosphorus, and alloy content of the test-bars. A machinability test is conducted on test-bars, as well as the common transverse, deflection, tensile, and hardness tests.

Test-bars studied include transverse bar and tensile specimen, step bar, contraction bar, flowability specimen, and various chill specimens. The microstructure of the test-bar is correlated with raw materials, processing, and resulting mechanical properties.

The text-books for this course include the following:—"Transactions of the American Foundrymen's Association"; "Sand Control," Scobie, 1940; "Testing and Grading of Foundry Sands," A.F.A., 1938; "Alloy Cast Irons," A.F.A., 1939; "Cast Metals Handbook," A.F.A., 1940; "The Microscope in Elementary Cast Iron Metallurgy," Allen, A.F.A., 1939; "Industrial Radiography," St. John and Isenburger, Wiley, 1934; "Chemical Analysis for the Foundry Control Laboratory," Scobie, 1939; and certain publications of foundry suppliers.

Foundry Problem Courses

Two problem courses, Foundry Research Problems and Advanced Engineering Problems, are offered to upper-class men and graduate students. Students electing to take these courses assist in research problems sponsored by the foundry department. The following are some of the research projects now being conducted:

(1) Effect of moisture control of the cupola air supply on the properties of the iron.
(2) Effect of combustion control in a cupola on the melting losses.
(3) Torsion impact testing of cast iron.
(4) Effect of furnace atmosphere on the porosity of pressure castings.
(5) Synthetic moulding sands.
(6) Rapid temperature measurement of cast iron and steel.
(7) Rapid methods of chemical analysis for the foundry.

Success of Foundry Control Method Course

The success of an elective course in a university curriculum may be based on the increase in enrolment in the course and in the number of students who find employment after graduation in the industry. Fig. 1 shows the increase in enrolment in the foundry control laboratory course and the two foundry problem courses. This rapid increase in enrolment has overcrowded the facilities which three years ago were considered more than adequate. Six of the students who took this course, and have obtained their University degrees, are now employed as foundry engineers, instructors of foundry practice, or research technicians.

The interest the students have in the foundry practice courses is shown by the recent formation of the first student chapter of the American Foundrymen's Association in the United States.

Comparison of Elements in Preventing Dezincification

The dezincification of alpha brasses is considered in relation to:—(1) Proper choice of an inhibitor, and (2) evaluation of possible detrimental effects of the inhibitors commonly used, in a Paper read by W. Lynes, of Revere Copper & Brass, Inc., at the recent Chicago meeting of the A.S.T.M. A survey of relevant published and unpublished information and tests in the laboratory indicate that dezincification may be successfully suppressed by around 0.03 per cent. of arsenic, antimony, or phosphorus without offsetting disadvantages.

A University Course in Foundry Control Methods*

By FULTON HOLTBY and H. F. SCOBIE

Probably no other industry has awakened so rapidly from several thousand years of dormant existence as has the foundry industry. Spurred by outside competition, hard-earned discoveries, and a new generation of technically trained men, the industry has thrown off the shackles of a craft and developed scientific foundry practice. As a result, it has been difficult for the universities and colleges to keep their foundry courses abreast of this recent rapid development of the foundry industry.

Five years ago the University of Minnesota began developing a series of modern foundry practice courses for future engineers. The growing response and continued interest shown by both the students and the industry have been highly encouraging. Prior to 1936, this university had offered only one foundry course, which, in the words of one student, consisted of "pounding sand, pouring book ends, and remelting scrap castings." The course was required of all mechanical engineering students and was taught by one instructor.

To-day the foundry department offers five major foundry courses, namely, Elementary Foundry Practice, required of all mechanical engineering sophomores; Intermediate Foundry Practice, elective to sophomores; Foundry Control Methods, elective to upper classmen; and two foundry problem courses, Foundry Research Problems and Advanced Engineering Problems, which are elective to upper classmen and graduate students. Now included on the personnel of the foundry department are an assistant professor, an instructor, a laboratory mechanic, three National Youth Administration student-assistants, and seven Works Progress Administration research assistants.

Elementary Foundry Practice Course

Each year approximately 225 students enrol in elementary foundry practice, which is required of all mechanical engineering students. The primary purpose of this course is to acquaint all mechanical engineering students with modern foundry practice, the possibilities and limitations of castings for engineering use, and the factors in design of castings.

The course consists of 20 hours of lecture and 30 hours of laboratory. Since the University of Minnesota operates on a 10-week quarter system instead of a 15-week semester system, the course is completed in 10 weeks. There are a definite number of operations and projects to be completed, and the course is as carefully laid out as any university course in chemistry or physics. A schedule of assignments is shown in Table I.

Four points are stressed repeatedly in this elementary course: (1) the development of the foundry industry during the past two decades, with the resulting betterment of products; (2) the importance of control of the foundry processes; (3) the practical knowledge it gives for work in other fields; and (4) the increasing opportunities for employment as a foundry engineer.

The idea that this is a new and rapidly developing phase of engineering makes it much easier to arouse and hold the students' interest. Problems of the local industry are discussed and solved in the classroom, and from this, the students realise that a scientific approach is important to a foundry problem. Students showing special aptitude in the elementary course are encouraged to take advanced work.

Intermediate Foundry Practice Course

Intermediate foundry practice is offered as an elective to sophomores who desire to continue their study of foundry practice. Each year, approximately 25 students take this course, which maintains their interest while they complete the chemistry and physics pre-requisites for the more advanced foundry courses. In this course, the students study the production of non-ferrous metal castings, malleable iron castings, and steel castings, and the principles of sand testing and control. Inspection trips are made to local foundries to study processes which cannot be carried out in the university foundry laboratory.

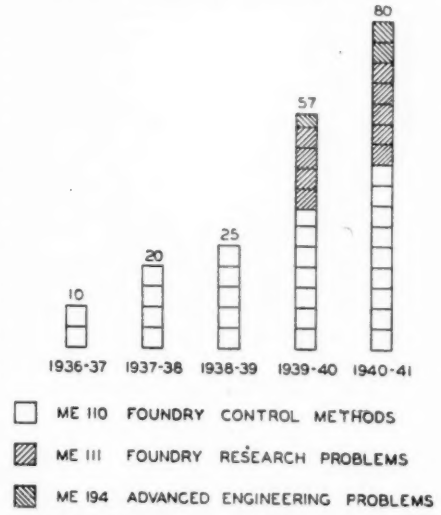

FIG. 1.—REGISTRATION IN ELECTIVE ADVANCED FOUNDRY COURSES.

Foundry Control Methods Course

This course was introduced 3 years ago, after a university study of the future of manufacturing process courses revealed that the rapidly developing foundry industry needed engineers, control laboratory technicians, and executives. Since neither laboratory nor equipment was available for such a course, the teaching staff and the students built a laboratory and most of its equipment at a minimum of expense in the university shops.

A 30 by 30-ft. laboratory was built as a mezzanine floor over part of the foundry. Laboratory benches, exhaust hoods, and cabinets were built and installed. An 8-k.v.a., multiple-tap, transformer and two silicon-carbide tube furnaces were made for secondary calibration of thermo-couples; a smaller coil-wound resistance furnace was made for primary calibrations. Aluminium castings, poured and machined in the shops, were combined with a motor-driven agitator to make a rapid clay washer, and a discarded gyratory riddle was rebuilt for testing grain-fineness of sands. The foundry department also designed and built a furnace and accessories for making rapid sulphur determinations. An obsolete X-ray machine was secured and rebuilt to deliver 280,000 volts at 5 milliamp. To protect operators from the rays, a special cubicle in one corner of the laboratory was lined with $\frac{1}{8}$-in. lead sheet. Special equipment was installed so that radon gas, which is obtained from the Department of Chemistry, could be used in making gamma ray studies. A control room and developing room completed the X-ray division.

For convenience in teaching, and to conform with industrial practice, the foundry control methods course is divided into the following sections:

(1) Chemical and mechanical control of foundry raw materials.
(2) Chemical and mechanical control of processing materials.
(3) Scientific control of manufacturing processes in the production of castings.
(4) Inspection, calibration, and maintenance of foundry production control equipment.
(5) Chemical, mechanical, and metallurgical inspection of the finished cast products.

Under the first section, the students learn some of the industrial methods of inspecting incoming raw materials such as pig-iron, scrap iron, scrap steel, coke, limestone, moulding sand, and core sand. Supervised by the teaching staff,

(*Continued on page* 272.)

TABLE I.—*Schedule for Elementary Foundry Practice at the University of Minnesota*, 1940–1941.

Lecture No.	Lecture subject.	Text Assignment.	Laboratory No.	Laboratory Assignment.
1	The Casting Industry	1–9	1	Demonstrations and Equipment Inspection.
2	Materials for the Foundry ..	10–29		
3	Bench Moulding Practice ..	30–39	2	Bench Moulding Projects No. 5, 7, and 50.
4	Floor Moulding Practice ..	40–49		
5	Machine Moulding Practice ..	50–67	3	Moulding Machine Projects No. 25, 27 and 29.
6	Materials for the Foundry ..	68–76		
7	Core Practice	77–85	4	Core Room Projects No. 10, 11, 13 and 15.
8	Cupola Melting Practice ..	88–99		
9	Cupola Melting Practice ..	100–109	5	Cupola Preparation and Charge Calculation.
10	Mid-quarter Examination ..	Review		
11	Melting Practice	110–117	6	Cupola Operation and Pouring.
12	Cleaning and Finishing	118–133		
13	Constitution of Cast Iron ..	135–151	7	Cleaning and Inspection of Castings.
14	Properties of Cast Iron	152–162		
15	Alloy Cast Iron	163–173	8	Electric Furnace Operation and Duplexing.
16	Malleable Iron Castings ..	192–201		
17	Steel Castings	202–221	9	Non-ferrous Moulding Projects No. 30, 31, and 32.
18	Non-ferrous Castings	222–251		
19	Casting Defects	Review	10	Non-ferrous Melting.
20	Design of Castings	253–263		
	Final Examinations			

* A Paper presented to the New York Convention of the American Foundrymen's Association. The Authors are, respectively, Assistant Professor of Mechanical Engineering and Instructor of Foundry Practice, University of Minnesota.

Annual Report of the Chief Inspector of Factories for 1940

REVIEW OF ACCIDENTS UNDER WAR CONDITIONS

In his Annual Report for 1940,* just issued, the Chief Inspector of Factories states that experience during the year has shown that some valuable lessons of the last war had been widely forgotten or were not yet sufficiently appreciated, and has provided us with further guidance for the future. He was thinking particularly of the lessons that excessive hours mean less production and that proper breaks and rest days are of great importance from the production standpoint. Happily a large number of factory managements do appreciate this, and while they recognise that the sacrifice of an occasional Sunday rest day and the working of very long hours for a short period may be necessary, and indeed result in greater output for the time being, they did not adopt systems of hours which, in the light of experience, were excessive and not calculated to produce the best output.

Other managements paid less attention to the lessons of experience or felt constrained to disregard them owing to insistent demands for greater output. Some check, however, can be exercised through the control over the hours of women by means of Emergency Orders under the Factories Act. Employees, too, required some restraint from a tendency to overwork themselves, whether from a desire to earn more wages or from patriotic but misguided motives. Much has been heard of so-called absenteeism, and it should be recognised that if people are expected to work for really excessive hours or without proper intervals for rest and recreation, there will be a reasonable tendency to take time off and stay away for odd days, thus disorganising production. On the other hand, with well-planned schemes of hours and rest days, legitimate grounds for losing time are largely absent.

Accident Prevention

It has been disconcerting to find, states the Report, not only that the figures for reportable accidents show very serious increases in 1940, but that the increases should, to a considerable extent, have been prevented. The figures for 1940 were 1,372 fatal and 230,607 non-fatal accidents, being about 24 per cent. and 20 per cent. respectively higher than the figures for 1939. These increases are much larger than those for 1939 as compared with 1938 (17 per cent. and 7 per cent.) and mean a great loss of production as well as much human suffering. Inspectors in all parts of the country agree that the main cause was the increase in the number employed on the war effort, but there are special features that point to a relaxation of care in certain directions. Inspectors also have to meet a certain criticism that accident prevention is rather an unworthy subject for consideration in wartime, when the men in the Forces are taking every kind of risk. The Chief Inspector points out, however, that the Services are most carefully trained not to take unnecessary risks.

The chief increases in accidents are shown both in those industries and on those machines that are concerned in the war effort. Increases of 33 per cent. in engineering works, 47 per cent. in the making of machines, motor vehicles, etc., and 21 per cent. in chemicals, show the extent to which the war effort influenced accident statistics. There has also been a serious increase in shipbuilding, particularly in fatal accidents. In contrast to this, the following figures show that even war conditions need not send up the accident rate. The figures refer to a large shipbuilding yard employing over 11,000 persons, where there is a keen and efficient safety officer to whose organisation and work these results are largely due. The number of accidents per 100 employed were 0.94 in 1937; 0.95 in 1938; 0.75 in 1939, and 0.66 in 1940. The seriousness of the increase in shipbuilding accidents is fully realised by the Shipbuilding Employers' Federation, who continue to call the attention of their members to this serious state of affairs. Inspectors also are taking the matter up with employers, and arrangements have been made in Glasgow to call together the Safety Officers, who have to be appointed at each yard under the Shipbuilding Regulations, in order that their knowledge may be pooled with a view to raising the standard of accident prevention in this dangerous trade.

Effect of Untrained Labour

The effect of the new and untrained labour can be seen in the increase of accidents on milling machines by 56 per cent., and on power presses by 48 per cent. In certain districts Factory Inspectors have also noticed a decided increase in accidents on automatic lathes and drilling machines. These machines are largely manned by unskilled or semi-skilled labour which is now coming into industry, and it is felt that in the rush for war production these new workers are not getting the training that they should have. Accidents due to loose hair and loose clothing have increased.

Workers new to industry and those transferred from safe trades have been watched. Inspectors report that both types show a tendency to accidents when handling articles to which they are not accustomed, such as steel turnings and glass goods. Some London managers dispersed to country districts complain that the new workers are not "factory-minded," a definition that seems to include discipline and machine awareness. Unaccustomed work has even sent up the accident rate of skilled men transferred to other work. An interesting illustration is the increase of adze accidents to carpenters and joiners transferred to boat building.

It must be recognised that the training of new labour coming into industry has been neglected while, in fact, it should have had more attention in wartime. Such training will not only prevent accidents but will the sooner get the new entrants into full production. It is recognised that this neglect is mainly due to scarcity of foremen, chargehands and setters-up on whom this training must devolve, and perhaps even more to the serious over-working of these most essential links in the chain of production. To help in overcoming the difficulty as far as is possible on the accident prevention side, a new departure was made in October, 1940, when a specific educative campaign for the prevention of accidents was launched.

Accident Proneness

A suggested cause of the increase of accidents was an increase of accident proneness in factories and areas that had been badly bombed; but so far as can be ascertained, there has been no increase of accidents in these areas which cannot be explained by other causes. There have been increases due to physical results of enemy action—falls while repairing roofs, falls over damaged floors, and the like, but there is no evidence pointing to any appreciable number of accidents due to nervousness or jumpiness caused by air raids. Much can be said on the other side: three cases are cited by the Chief Inspector.

(1) Skilled men in a Midland factory still continuing their work to the finest limit of engineering practice in wet weather on rusty lathes without any roof to the shop. (2) A more riotous scene of a shop full of women and girls giving practically full output from automatic machines in a roofless shop, working in heavy rain in mackintoshes under the protection of a few tarpaulins, to a full chorus of "It ain't gona rain no more." (3) A woodworking shop in the East End of London where the machines were got to work from a temporary steam engine before even the walls were erected around them.

Accidents to Young Persons

The decrease in accidents to young persons reported last year has unfortunately not been maintained. The actual figures are 26,492 accidents to boys and 8,493 to girls, an increase of 18 per cent. and 11 per cent. respectively. Compared to the decreases shown in the previous three years this is disappointing and points to the fact that, under the stress of war, the ground gained in the last few years has been lost. The immediate cause of the increase is, to some extent, due to the fact that more of the young persons available for industry during this year have gone into factories; there has also been some increase in the hours worked and thus in the hours of exposure to risk.

Ventilation

As stated last year, the necessity for an unprepared nation to take hurried steps to black-out the factories completely upset the means of ventilation in many cases, and particularly where work continued at night. While many improvements were made in the closing months of 1939, the staff continued to follow up this problem in 1940, and many nights were spent from dusk to dawn inspecting factories where night shifts were at work. Special attention was also given to shops in which heat processes were carried on, *e.g.*, bakehouses, rubber works, foundries, and the like.

Inspectors report that in practically all cases managements were aware that conditions were bad and were only too ready to take advice, but some time was necessary before results were obtained.

Serious difficulties have had to be faced in steelworks as a result of the complete enclosure of melting shops, etc.; these have been dealt with conjointly with the Anti-glare Department of the Ministry of Home Security, and the difficulties have been partly overcome by the provision of movable doors, which can be open by day, though they must be closed at night, and by the introduction of power-driven fans of both plenum and extraction types. In some other factories large hooded shafts above furnaces have proved effective, but stress is laid upon the necessity for making these of ample size. Another means of reducing the amount of heat radiated from these furnaces is the fitting of water-cooled doors: this system has the additional advantage of reducing the warping of the doors and the consequent dissipation of heat. With regard to the use of water for keeping down the temperature in forges, one Inspector writes: "On complaining of the high degree of radiant heat from a billet furnace to which workers at nearby machines were subjected, I was taken to see another similar furnace in front of which a curtain of cold water was continuously falling. The difference was very marked, and it is the intention of the firm to extend this arrangement to other furnaces. Some humidification of the atmosphere would, of course, result, but, with several fans in operation and a general tendency for the atmosphere to be dry, I do not think conditions would become objectionable."

Lighting

Under war conditions the time spent in working with artificial light has become far greater owing to the increase in night work and overtime and to the partial blacking-out of factory premises even in day-time. The inevitable result must be to aggravate the ill-effects of bad lighting on workers already subject to the strain of working at high pressure for long hours. At the same time, the increased output to be obtained with improved lighting has become a matter of urgent national importance. The Departmental Committee on Lighting in Factories was therefore requested to review the position in the light of changed conditions, and in June the Committee submitted a report recommending a substantially higher standard of lighting than had previously been suggested as a legal minimum. On the basis of their recommendations, and after discussion with interested parties, a draft Code of Regulations was issued, containing provisions for minimum standards of general illumination and for eliminating glare and troublesome shadows. This draft Code, with a few minor amendments, has since been brought into force as the Factories (Standards of Lighting) Regulations, 1941. The application of the Regulations is limited to factories in which shifts or relatively long hours are being regularly worked, the general effect being to include factories in which the work is essential to the nation's war effort and involves substantial use of artificial lighting.

It is necessary to remember that for types of work involving relatively close attention to detail general lighting to the minimum standard laid down in the Regulations is not in itself sufficient and needs to be supplemented by additional lighting, either local or general, and this is made clear in the Regulations themselves.

* Cmd. 6316. H.M. Stationery Office, York House, Kingsway, London, W.C.2. (Price 4d. net.)

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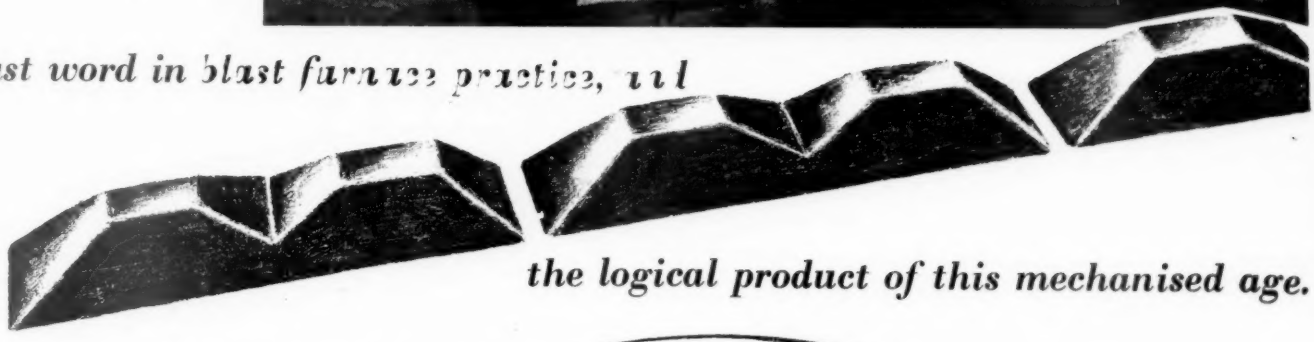

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The Week's News in Brief

Trade Talk

WATSONS (METALLURGISTS), LIMITED, have removed from 29, Meadow Bank Avenue, Sheffield, 7, to Pulvometal Works, Mill Lane, Dronfield.

A PLEA for the formation of a Ministry of Overseas Trade was made by Mr. D. G. Carmichael at a meeting in Edinburgh of the Incorporated Sales Managers' Association.

LEGISLATION to extend the terms of patents for those patentees who have suffered loss or damage by reason of the war will be introduced shortly by the President of the Board of Trade.

THE CUTLERY TRADE BOARD has made an Order incorporating into a flat rate award the bonuses, amounting in all to 15 per cent., given to workers at different periods since the outbreak of war.

AT A MEETING of the joint board for the South Wales Siemens steel trade, held at Swansea, the employers conceded the cost of living bonus to "spotters," and a committee was appointed to investigate the provision of canteens.

THE MINISTRY OF WORKS has made the Control of Rates of Hire of Plant Order, 1941, which sets out a list of maximum rates at which various types of building and civil engineering contractors' plant can be let out on hire, together with the conditions.

THE HAMMOND LANE FOUNDRY COMPANY, LIMITED, of Dublin, have opened up a new department for the manufacture and supply of black-heart malleable castings. Boot protectors and agricultural implement components constitute the main output.

MANUFACTURERS from all parts of South Wales met at the Engineers' Institute, Cardiff, recently, with the object of relieving "bottle-necks" of production by an exchange of tools. This mutual aid scheme has operated in other parts of the country with considerable success.

COMPLETE UNIFORMITY OF DESIGN for utility electrical products used in the industrial and domestic fields was urged as a prerequisite of successful post-war trading, both at home and abroad, by Mr. E. G. Taylor in his inaugural address as chairman of the Mersey and North Wales centre of the Institution of Electrical Engineers.

THE NORTH-WESTERN REGIONAL BOARD Production Executive is strongly pressing engineering firms in the area to engage women to release men for the Services. Many firms have considerably extended their employment of female labour, but the Board views with concern the apparent reluctance of many firms to employ women at all.

MANUFACTURERS of contractors' plant have formed the Federation of Manufacturers of Contractors' Plant for the purpose of representing their common interests in dealing with major problems arising from the war and in preparation for post-war conditions. The secretaries are Binder, Hamlyn & Company, 12 and 13, South Place, London, E.C.2.

A JOINT MEETING of the Ebbw Vale Metallurgical Society, the Newport and District Metallurgical Society, the Swansea Technical College Metallurgical Society and the Iron and Steel Institute will be held on Wednesday, October 29, 1941, at 7 p.m., at the Rational Hall, Alexandra Street, Ebbw Vale. Mon., when Mr. L. J. Davies will preside, and Principal C. A. Edwards, D.Sc., F.R.S., will deliver a lecture on "The Annealing of Mild Steel Sheets."

UNDER THE MACHINERY, PLANT AND APPLIANCES (Control) (No. 5) Order, 1941 (S.R. & O. 1941 No. 1610, price 1d.), dated October 13, 1941, Lubricating oil washing machinery and plant, has been added to the Schedule of goods the supply of which is subject to Board of Trade Licence. Application forms for licences should be obtained from the Industrial Supplies Department (Machinery Licences Division), Board of Trade, 1-6, Tavistock Square, London, W.C.1.

A LETTER RECEIVED FROM Major A. Rhydderch, late of Hadfields, Limited, and Lake & Elliott, tells us that the name of his company has been changed from Rhydderch Quality Castings to Quality Castings Pty. Company, the address of which is McEvoy Street, Waterloo, N.S.W. Apart from making steel castings, for which purpose a large-capacity high-frequency furnace is used, the firm is installing light rolling mills and a forge, with the object of furnishing the market with special sizes of tool steel and the like.

CONCENTRATION OF INDUSTRY has resulted in the release of 145,000 workers and of 45,000,000 sq. ft. of factory space. In nearly all the industries within the scope of the Limitation of Supplies Order concentration has been carried through on the required scale. In addition to those on the original list, concentration is being applied to other industries, including iron and steel, bicycle, and china clay. Concentration of the steel sheet industry is nearly completed. Far less compulsion has been required than was at first expected. Voluntary arrangements have brought about fully two-thirds of the concentration. Compulsion has been applied by nominating certain firms as nucleus firms on condition that they took over the production of other specified firms.

THE MIDLAND REGIONAL BOARD, which includes representatives of both employers and of the trade unions, believes that in some factories production could be increased and needless misunderstandings avoided if an arrangement was made whereby a Joint Production Inquiry Committee could be set up, at which an exchange of views could take place between equal numbers of representatives of the management and workpeople. The Board is sending notification to all engineering firms in the region recommending that such a committee be appointed whenever a desire for it is expressed, or whenever it seems likely that it could usefully function. Such committees would in no way encroach upon the existing machinery adopted for the discussion and settlement of questions relating to wages or working conditions.

THE DIFFICULTIES TO THE FUTURE of any drastic severance of export connections was stressed by Lord Dudley Gordon, president of the Federation of British Industries, at the last meeting of the Grand Council of the Federation. Export trade, he said, could not be turned on or off like a tap, and trade once lost was extremely difficult to regain. Industry realised that further restrictions in the export trade might be necessary, but industrialists should be told frankly precisely what goods could be exported, to what extent and to what markets, and what goods must, for the moment, be regarded as incapable of export except to certain limited destinations. Touching on the question of reconstruction, Lord Dudley Gordon said it was too early yet to come to definite conclusions on such a question, which must depend on the duration of the war and the position of the various countries of the world at the end of it. At a later stage he would propose to the Federation that a representative committee should be set up to deal with post-war reconstruction, but he did not feel that the time had yet arrived to take that step.

Personal

MR. F. S. MITMAN has been appointed Adviser on Fabricated Light Metals to the Ministry of Aircraft Production.

CAPT. H. LEIGHTON DAVIES was re-elected chairman at the annual meeting of the Welsh Plate and Sheet Manufacturers' Association at Swansea.

MR. GEORGE CHESTER has been appointed to the Industrial and Export Council in the place of Mr. John Brown, who has resigned. Mr. John Brown is secretary of the British Iron and Steel Trades Association.

MR. F. W. HALL, secretary of the brassfoundry department at William Doxford & Sons' shipyard, Sunderland, has completed 50 years with the firm, and has been presented by the management, staff and foremen with a silver salver.

MR. T. MAKEMSON, A.T.C.M., secretary of the Institute of British Foundrymen, and Mr. E. A. Chell, director of the Rodney Foundry Company of London, have been appointed Joint Directors for Iron Castings, Iron and Steel Control, Ministry of Supplies.

CAPT. A. H. READ, chairman of the British Iron & Steel Corporation (Scrap), Limited, is a member of the Salvage and Recovery Board, constituted by the Minister of Supply under the chairmanship of Sir Vyvyan Board, to deal with all questions relating to the salvage of waste materials and the reclamation of damaged materials.

MR. JOSEPH JAMES CARTER, who has been re-elected president of the British Engineers' Association, is managing director of Crossley Bros., Limited, Openshaw, Manchester, and chairman of Crossley-Premier Engines, Limited, Sandiacre, Nottingham, Diesel-engine makers. This will be Mr. Carter's third successive year of office.

Obituary

MR. HERBERT WHITE, a partner in the firm of R. White & Sons, Railway Engineering Works, Ditton Road, Widnes, died on October 10, after being connected with the firm for over fifty years. The business will be carried on as usual by the remaining partner, Mr. J. W. White.

MR. OSWALD B. LEIGH has died at Broughton, near Scunthorpe, where he had recently been living in retirement. Member of a Lancashire family and son of the late Sir Joseph Leigh, Mr. O. B. Leigh was associated with the North Lincolnshire Iron Company, Scunthorpe's first steel-making concern. He was 64 years of age.

WE REGRET TO ANNOUNCE the death of Mr. John H. Every, the proprietor of John Every, of Phœnix Iron Works, Lewes. He was 84 years old and for the last two or three years had been unable to speak or walk, consequent upon a stroke. In South Sussex he was held in the highest esteem, and was one of the first Freemen of Lewes. As an ironfounder, he took no prominent part in either the employers' or technical organisations, but his researches into the history of cast iron met with very wide approbation. At his foundry several rooms were set aside as a museum, the exhibits in which disclosed the degree of technical skill achieved and the important position held by the Wealdon iron industry in the fifteenth and sixteenth centuries. Whilst most of his work appears in the proceedings of the Sussex Archæological Society, he did in 1932—that is when he was 75 years of age—present a Paper before the London Branch of the Institute of British Foundrymen.

Reports and Dividends

Wales—Interim dividend of 5%.

Metal Agencies—Interim dividend of 3½% (same).

Lightalloys—Final dividend of 12½%, making 25% (same).

Drake & Gorham—Dividend of 5% on the ordinary shares (2%).

Blakey's Boot Protectors—Final dividend of 7½%, making 15% (same).

T. M. Birkett & Sons—Final dividend of 10% (same), making 15% (same).

Martin Bros. (Machinery)—Dividend of 12½% for the year to June 30 last (10%).

Cochran & Company, Annan—Final dividend of 2½%, making 4%, tax free (5%, tax free).

Herbert Morris—Final dividend of 15% (17½%) on the ordinary shares, making 20%, tax free (25%, tax free).

R. & W. Hawthorn Leslie—Final ordinary dividend of 7%, making 10%, less tax (same), plus a bonus of 5%, less tax (2½%, tax free).

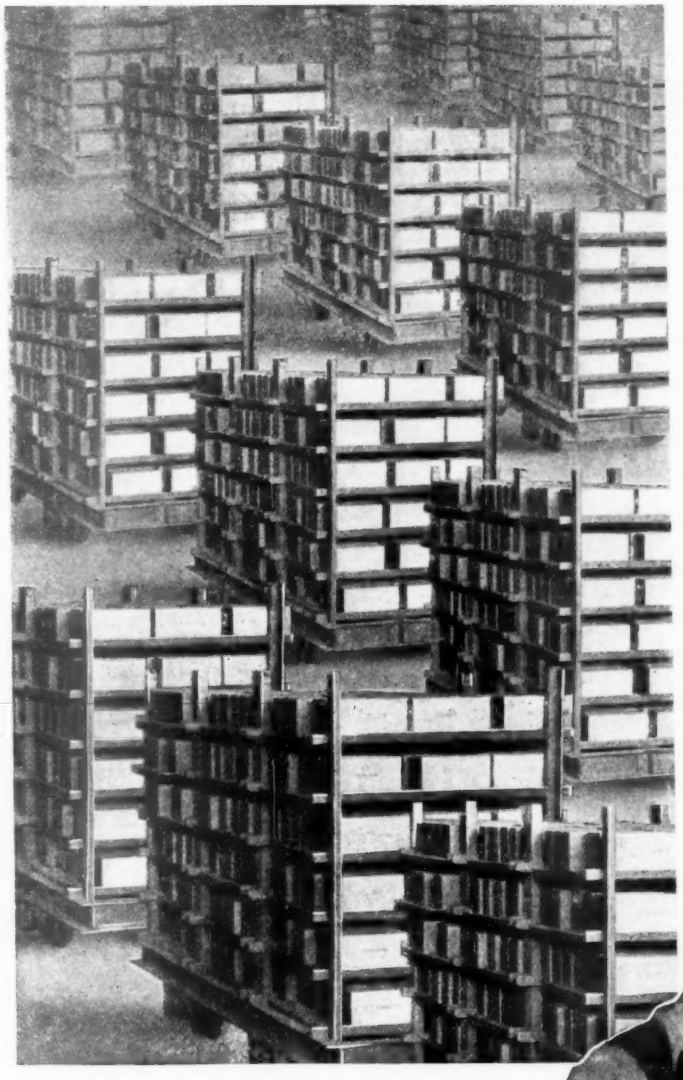
Electrolytic Zinc Company of Australasia—Net profit for the year ended June 30 last, after providing £125,000 for amortisation and depreciation and £320,000 for taxation, £362,784 (£448,782).

Parsons Marine Steam Turbine—Profit to June 30 last, after writing off expenditure on experimental and pioneer work and after providing for depreciation, upkeep of patents, and taxation, £53,065 (£78,211); to special war reserve, £20,000; dividend of 10% (same), £31,692; forward, £15,417 (£14,044).

J. Blakeborough & Sons—Net profit for the year to June 30, after depreciation, £149,258 (£82,080); dividend on the 5% preference shares, £2,892; interim dividend of 5% on the ordinary shares, £3,364; interest on the 7% (20-year) cumulative notes, £2,790; provision for taxation, £115,622; War Damage contributions, £5,310; provision for redemption of notes, £5,420; to pension reserve, £5,000; final dividend of 5% (making 10%) and a bonus of 10% on the ordinary shares, £8,775; forward, £11,320 (£11,847).

Essential Work (Iron and Steel Industry) Orders

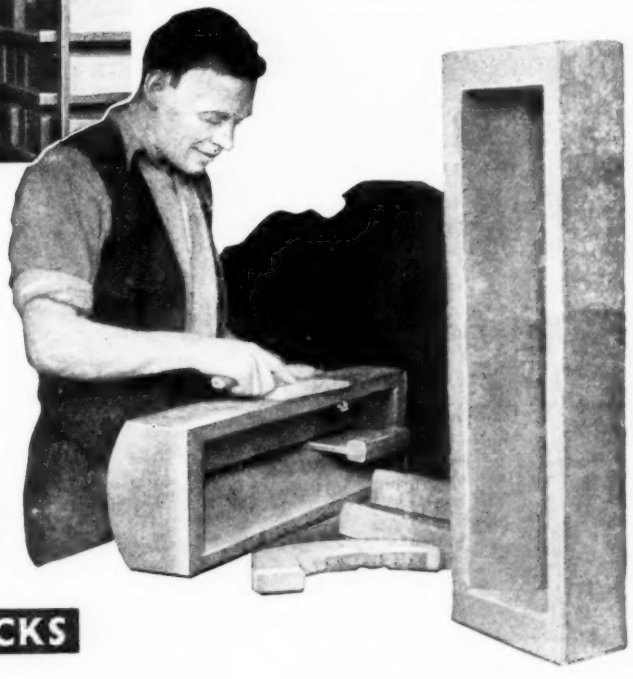
The Essential Work (Iron and Steel Industry) (No. 2) Order, 1941, has been made by the Minister of Labour and National Service. It is supplementary to the original Order, its purpose being to schedule agreements between the employers' associations and various craft or district unions which are in addition to those appended to the Essential Work (Iron and Steel Industry) Order, 1941. The two Orders together are to be cited as the Essential Work (Iron and Steel Industry) Orders, 1941.



A MILLION BRICKS

- or a few specials

THE Glenboig range of refractories is limited only by the needs of users. Abundant sources of raw materials from Glenboig mines, covering a wide range of properties assessed by careful research, enable Glenboig to select fireclays well suited to any particular job. Consistently uniform quality is built into Glenboig products by a system of control rigidly applied at all manufacturing stages—grinding, mixing, burning and so on. Hence, irrespective of the size of the order, the user is assured of obtaining Glenboig fire bricks which will provide long service with a minimum of stoppages and repairs. Technical representatives are always at the service of users to assist in the choice of refractories to meet particular conditions of service.



42/44% Al_2O_3
GLENBOIG SPECIAL
GLENBOIG SPECIAL CROWN

36/38% Al_2O_3
GLENBOIG · GLENBOIG CROWN
CASTLECARY

34/35% Al_2O_3
DYKEHEAD · GEM

Glenboig

FIREBRICKS

The GLENBOIG UNION FIRE CLAY CO. LTD., 48 WEST REGENT STREET, GLASGOW, C.2

GENERAL REFRACTORIES LTD., GENEFAX HOUSE, SHEFFIELD 1

G.P. 67

Raw Material Markets

Ironfoundries are of great importance in the drive for still larger outputs of war materials, and it is evident that they are playing their part well. Heavy engineering foundries are almost solely engaged on contracts bearing high-priority labels, and their outputs are bespoken over a considerable period ahead. The same cannot be said of the makers of light castings, who are affected by the various restrictions common to-day to so many trades not called upon to cater for the needs of Government departments. Some light-castings works have been able to adapt their plant to assist in the war effort, but this applies to a comparatively few concerns. The supply of high-phosphorus iron, which is largely used in the manufacture of light castings, is quite sufficient to meet all demands, and users are permitted to take in stocks.

Pig-Iron

MIDDLESBROUGH—Ironworks in Derbyshire and Northamptonshire are dealing quite satisfactorily with the demand for foundry qualities of pig-iron emanating from the North-East Coast area, and licences generally are issued to cover all needs. High-phosphorus iron is in good request by local foundrymen, many of whom are employed on important contracts. The heavy foundries are especially busy. Most of the iron manufactured in this district is suitable only for steelworks, as the demand is so intense from these sources that production of Cleveland foundry grades has been virtually suspended.

Steelworks also are assured of the bulk of the local output of hematite, for which there is strong pressure. There is insufficient of this type of iron to meet all inquiries, so that distribution has to be arranged very carefully by the Control authorities. The latter have fair-sized stocks of imported hematite still on hand, but these supplies are only drawn upon in cases of the utmost urgency. Hematite users are encouraged to utilise other descriptions of iron where satisfactory results can be obtained, and this practice has relieved the situation considerably.

LANCASHIRE—With the light-castings trade and jobbing foundries still in need of orders, the chief support of makers of foundry pig-iron continues to come from the heavy foundries, which are operating to capacity. Lancashire users are drawing their supplies from Derbyshire and Staffordshire, and producers in these counties are despatching adequate tonnages. In some instances progress is being made in the building up of stocks at the receiving end. Although deliveries of hematite have shown a slight improvement, supplies are still short of actual needs.

MIDLANDS—Renewed efforts to ease the position of the light-castings trade by means of increased facilities for exports do not appear to have met with any success, and business in this section remains at a low ebb. The Government is unwilling to grant an extension of permits for shipping products of the trade, and as the home demand is much below the average level, outlets are severely restricted. Most works have reserve stocks of high-phosphorus iron on hand, as it has been possible to secure purchasing licences easily for some time past, but there have been instances of late of foundries failing to take up the full tonnages allocated to them. In contrast, it is difficult for users of low-phosphorus iron and hematite to get all they require, and heavy engineers, who are the chief consumers, can only obtain licences if they can assure the Control that the metal is required for important work.

SCOTLAND—Pig-iron production in this area is at peak levels, but even so some difficulty is felt in satisfying all demands. Hematite, especially, is on the short side. Marine and other heavy engineering concerns are making very large demands, and, being fully booked for some time ahead, will continue to tax productive capacity. Much quieter conditions prevail in the light-castings industry, where only a few works are operating on Government orders. Business with the remaining firms is very quiet indeed. Consumers of high-phosphorus iron are able to obtain all they require from the English Midlands.

Coke

Consumers of foundry coke have every reason to be satisfied at the rate at which supplies are reaching them; many users have quite large stocks and fresh supplies are arriving to replace fuel used up. There is no change in the quotation of 62s. 9d. per ton for Durham best foundry coke for delivery to Birmingham and Black Country stations. Coke prices are officially controlled.

Steel

Now that the steel industry has settled down to the new conditions made imperative by the development of the war effort, there is, generally speaking, little change to report from week to week, as works are going all out to see that urgent needs are met with the minimum of delay. The main feature of the past week or two has been the increasing activity among makers of structural qualities of steel, and delivery dates for these products tend to lengthen. Demand for angles, channels and joists, etc., is considerably above that of a month or two ago and is apparently rising. Plate mills are as busy as ever, while the position of most sheet-makers is fairly good. Alloy steels continue to be heavily booked on forward account.

Scrap

There has been no deterioration in the scrap iron and steel position, and deliveries, with few exceptions, seem to be adequate. Buyers are displaying keenness to augment their deliveries in some instances, while others have as much metal on hand as they can accommodate conveniently. There is every incentive to instil even greater energy into the scrap collection campaign, as imports of metal have been drastically curtailed, if not entirely severed. From many parts of the country good reports are forthcoming in this connection.

Metals

COPPER—Demand for copper remains at a high level, distribution generally being restricted to essential manufacturers. The Control authorities are endeavouring to conserve supplies of virgin metals by encouraging consumers to utilise larger tonnages of scrap than usual. Civilian consumption of copper has been cut severely. The domestic copper statistics for September compiled by the American Copper Institute indicate that blister output in that month was 82,071 short tons, compared with almost 85,000 tons in August; refined production was only 80,961 tons in September, against 85,426 tons in the previous month. Refined stocks were lower at 63,670 tons, which compares with 72,154 tons in August. Deliveries last month were slightly above the August level, the figures being 120,429 tons and 117,262 tons respectively. The U.S. Metals Reserve Company has purchased an additional 96,000 tons of Latin-American copper for November-December shipment at 11.25 cents per lb., c.i.f. Under a new Order the U.S. Government has forbidden the use of copper in non-defence building construction after November 1 until the end of the year, except for electric wiring.

A Bill which proposes a tax of 0.22 pesos of 6d. (gold) per kilo upon exports of copper, payable by the shippers, in the currency of the country to which the copper is destined, at the official rate of exchange, or in U.S. dollars or other foreign currency, has been introduced by the Chilean Government. The foreign exchange thus obtained would be sold to the Central Bank and the peso proceeds credited to a special account at the Treasury, to be applied, over a period of three years, in financing various public works.

TIN—The London tin market is still rather colourless, and prices have been steady. The disturbed international situation in the Far East has not, of course, helped matters. Requirements in the United Kingdom appear to be satisfied quite easily, while in the United States the maximum price is steady at 52 cents per lb.

It is understood that the Belgian Congo, the Netherlands East Indies and Nigeria have all sent official replies to the International Tin Committee accepting the standard tonnages allotted them for the next restriction period, which begins on January 1. Thailand, Bolivia and Malaya have still to reply. It is fully expected that Malaya and Bolivia will accept their allotted standards, but the position of Thailand remains uncertain, although it is now felt that that country will not jeopardise the restriction scheme by refusing to co-operate.

Tin prices on the London Metal Exchange during the past week have been as follow:—

Cash—Thursday, £255 15s. to £256; Friday, £255 10s. to £255 17s. 6d.; Monday, £255 15s. to £256; Tuesday, £256 to £256 5s.; Wednesday, £255 15s. to £256.

Three Months—Thursday, £260 to £260 5s.; Friday, £259 10s. to £260; Monday, £259 10s. to £259 15s.; Tuesday, £259 10s. to £260; Wednesday, £259 5s. to £259 10s.

SPELTER—The brass and die-casting industries continue to operate to capacity and very large tonnages of spelter are being absorbed. There is more activity to report in the demand for galvanised sheets, so that slightly increased supplies are being consumed in this direction. In the United States, the Office of Price Administration has advanced the maximum price for spelter from 7.25 to 8.25 cents per lb., East St. Louis, and it is hoped thereby to stimulate domestic production. The advance in the ore price caused business to be rather more active, and last week sales totalled 12,040 tons, which is the highest weekly turnover for eleven years.

LEAD—There is quite a fair demand for lead in the aggregate, but the reduced activity in the building industry is still keenly felt. Cable and battery makers are busy and are taking up considerable tonnages of lead. The U.S. Government has placed lead distribution under a system of full priorities, so that civilian needs there will be met only when the nature of the work in hand is regarded as important.

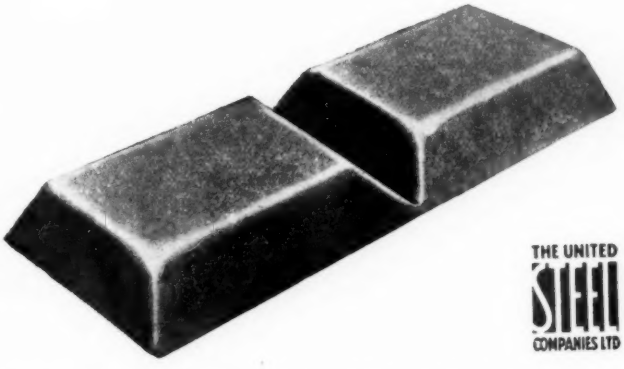
WILLIAM OLSEN LTD.
HULL
GENERAL
FOUNDRY SUPPLIES
PATTERN MAKER'S SUNDRIES
CORE BOXES
ALL KINDS — MADE TO ORDER
Wire Brush Manufacturers
FOUNDRY BRUSH GOODS—All kinds

WE SHOT OR SAND-BLAST
FOR ALL TRADES
Airless and Pressure
Blast Cleaning Plants
AIR COMPRESSORS
DUST ARRESTERS
CHILLED IRON SHOT—
BLASTYTE
FOUNDRY EQUIPMENT
ESTABLISHED RJR OVER 50 YEARS.
TELEPHONE MID. 2281 2282
R.J. RICHARDSON & SONS LTD.
COMMERCIAL ST. BIRMINGHAM.1

"Can't I sell you a pig in a poke Mr Brown"?

Mr. Brown, as a knowledgeable foundryman, is hardly likely to jump at the offer. Why should he? He knows that sand-cast pig will have a good deal of sand adhering to it, which will have to be fluxed with limestone at the cost of extra coke. There will also be a proportion of unwieldy sows which will add to his troubles.

No! Mr. Brown will probably buy Workington machine-cast hematite iron, knowing that every slab in a cast is uniform in analysis, that it comes in handy-sized pieces which do not "hang" in the cupola. He knows, too, that he is getting 100% of usable iron for his money and will require less limestone and coke in the cupola. In short, he knows exactly what he is buying.



THE UNITED STEEL COMPANIES LTD

WORKINGTON IRON & STEEL CO.
BRANCH OF THE UNITED STEEL COMPANIES LIMITED WORKINGTON CUMBERLAND

W 56

RAW MATERIALS—PRICE LIST

Wednesday, October 22, 1941

COPPER*

	£	s.	d.
Electrolytic	62	0	0
High-grade fire-refined	61	10	0
Fire-refined of not less than 99.7 per cent.	61	0	0
Do., do., 99.2 per cent.	60	10	0
Black hot-rolled wire rods	65	10	0

TIN

	£	s.	d.
Standard cash	255	15	0
Three months	259	5	0
Settlement	255	15	0
Official average Cash, Sept.	256	9	$10\frac{7}{11}$
Do. Three Months, Sept.	259	13	$3\frac{6}{11}$
Do. Settlement, Sept.	256	9	$1\frac{1}{11}$

SPELTER*

	£	s.	d.
G.O.B. (foreign) (duty paid)	25	15	0
Do. (domestic)	26	10	0
"Prime Western"	26	10	0
Refined and electrolytic	27	5	0
Not less than 99.99 per cent.	28	15	0

LEAD*

	£	s.	d.
Good soft pig-lead (foreign) (duty paid)	25	0	0
Do., do., (Empire and domestic)	25	0	0
English	26	10	0
Sheets, home	35	10	0
Do. export, f.o.b.	31	0	0
Pipes, home	35	0	0
Do. export, f.o.b.	31	10	0
Tea lead (nom.)		—	

ALUMINIUM

	£	s.	d.
Ingots	110	0	0
Wire, 10g.		nom.	
Sheets		nom.	
Circles, 20/24g.		nom.	

ZINC SHEETS, etc.

	£	s.	d.
Sheets, 10g. and thicker, ex works	39	2	6
Rolled zinc (boiler plates), ex works	37	2	6
Zinc oxide (Red Seal), d/d buyers' premises	28	7	6

ANTIMONY

	£	s.	d.
English, 99%, delivered	120	0	0
Crude, spot, home trade	100	0	0

QUICKSILVER

	£	s.	d.
Quicksilver, ex w'hse London	47	15	0

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	3s.	0d.
Finished bars, 18% tungsten	3s.	10d.
Finished bars, 22% tungsten	4s.	4d.

Per lb. d/d buyers' works.

NICKEL SILVER, etc.

	Per lb.
Ingots for raising	10d. to 1/4
Rolled—	
To 9 in. wide	1/4 to 1/10
To 12 in. wide	1/4½ to 1/10¼
To 15 in. wide	1/4½ to 1/10½
To 18 in. wide	1/5 to 1/11
To 21 in. wide	1/5½ to 1/11½
To 25 in. wide	1/6 to 2/–
Ingots for spoons and forks	10d. to 1/6½
Ingots rolled to spoon size	1/1 to 1/9½
Wire round—	
To 10g.	1/7½ to 2/2½

with extras according to gauge.

Special 5ths quality turning rods in straight lengths, 1/6½ upwards.

* Maximum prices per long ton delivered to buyers' premises.

FERRO-ALLOYS AND STEEL-MAKING METALS

	£	s.	d.
Ferro-silicon (5-ton lots)—			
25%	21	5	0
45%	23	10	0
75%	36	10	0
Ferro-vanadium—			
35/50%	15/6 lb. Va.		
Ferro-molybdenum—			
70/75% carbon-free	6/– lb. Mo.		
Ferro-titanium—			
20/25% carbon-free	1/9 lb.		
Ferro-tungsten—			
80/85%	5/1 lb.		
Tungsten metal powder—			
98/99%	5/2½ lb.		
Ferro-chrome—			
2/4% car.	—		
4/6% car.	47	0	0
6/8% car.	47	0	0
8/10% car.	—		
Ferro-chrome—			
Max. 2% car.	1/0½ lb.		
Max. 1% car.	1/1¼ lb.		
Max. 0.5% car.	1/1½ lb.		
70% carbon-free	—		
Nickel—99.5/100%	£190 to £195		
"F" nickel shot	175	0	0
Ferro-cobalt, 98/99%	8/9 lb.		
Metallic chromium—			
96/98%	3/9 lb.		
Ferro-manganese—			
76/80% loose	18	10	0
76/80% packed	20	0	0
Metallic manganese—			
94/96% carbon-free	1/9 lb.		

Per ton unless otherwise stated, basis 2-ton lots, d/d Sheffield works.

SCRAP*

	£	s.	d.		£	s.	d.
SOUTH WALES—							
Short heavy steel, not ex. 24-in. lengths	4	2	0	to 4	4	6	
Heavy machinery cast iron					4	7	0
Ordinary heavy cast iron					4	2	0
Cast-iron railway chairs					4	7	0
Medium cast iron					3	18	3
Light cast iron					3	13	6
MIDDLESBROUGH—							
Short heavy steel	3	19	9	to 4	2	3	
Heavy machinery cast iron					4	11	9
Ordinary heavy cast iron					4	9	3
Cast-iron railway chairs					4	9	3
Medium cast iron					3	19	6
Light cast iron					3	14	6
BIRMINGHAM DISTRICT—							
Short heavy steel	3	14	9	to 3	17	3	
Heavy machinery cast iron					4	12	3
Ordinary heavy cast iron					4	7	6
Cast-iron railway chairs					4	7	6
Medium cast iron					4	0	3
Light cast iron					3	15	3
SCOTLAND—							
Short heavy steel	3	19	6	to 4	2	0	
Heavy machinery cast iron					4	14	3
Ordinary heavy cast iron					4	9	3
Cast-iron railway chairs					4	14	3
Medium cast iron					3	17	3
Light cast iron					3	12	3

* Delivered free to consumers' works in England and Wales. For deliveries of cast-iron scrap free to consumers' works in Scotland, the above prices less 3s. per ton, but plus actual cost of transport or 6s. per ton, whichever is the less. All prices: Plus 3½ per cent. dealers' remuneration: 50 tons and upwards over three months 2s. 6d. extra.

PIG-IRON*

N.E. COAST (d/d Tees-side area)—	
Foundry No. 1	131/–
„ No. 3	128/–
„ No. 4	127/–
Forge No. 4	127/–
Hematite No. 1	138/6
Hematite M/Nos.	138/–
N.W. COAST—	
Hem. M/Nos. d/d Glasgow	138/6
„ d/d Birmingham	150/–
MIDLANDS (d/d Birmingham dist.)—	
Staffs No. 4 forge	129/–
„ No. 3 fdry.	130/–
Northants forge	126/6
„ fdry. No. 3	127/6
„ fdry. No. 1	130/6
Derbyshire forge	129/–
„ fdry. No. 3	130/–
„ fdry. No. 1	133/–
Phosphorus 0.5% to 0.75%	137/6
Phosphorus 0.1% to 0.5%	140/6
SCOTLAND—	
Foundry No. 1, Grangemouth	127/3
„ No. 3, Grangemouth	124/9
Cleveland No. 3, Glasgow	131/–
„ „ Falkirk	128/–
Scottish hem. M/Nos. d/d	138/6
SHEFFIELD (d/d district)—	
Derby forge	126/6
„ fdry. No. 3	127/6
Lincs forge	126/6
„ fdry. No. 3	127/6
W.C. hematite	144/–
LANCASHIRE (d/d eq. Man.)—	
Derby fdry. No. 3	133/–
Staffs fdry. No. 3	133/–
Northants fdry. No. 3	131/6
Cleveland fdry. No. 3	133/–
Cylinder and Refined Irons.	
North Zone	174/–
South Zone	176/6
Refined Malleable.	
Birmingham and S. Staffs	171/6
Cold Blast.	
South Staffs	220/6

* Prices of hematite and basic pig-iron, and of foundry and forge iron with a phosphoric content of not less than 0.75 per cent., are subject to a rebate of 5s. per ton under certain conditions.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms and Slabs.

	£	s.	d.
BASIC:			
Soft, u.t., 100-ton lots	12	5	0
Tested, up to 0.25% C.	12	10	0
Tested, 0.25 to 0.33% C.	12	12	6
Tested, 0.33 to 0.41% C.	12	15	0
Hard (0.42 to 0.60% C.)	13	17	6
„ (0.61 to 0.85% C.)	14	7	6
„ (0.86 to 0.99% C.)	14	17	6
„ (1% C. and up)	15	7	6
Silico-manganese	17	5	0
Free-cutting	14	10	0
SIEMENS MARTIN ACID:			
Up to 0.25% C.	15	15	0
Case-hardening	16	12	6
Silico-manganese	17	5	0

Billets, Blooms and Slabs for Forging and Stamping.

Basic soft, up to 0.25% C.	13	17	6
Basic hard, 0.41 to 0.60% C.	14	10	0
Acid, up to 0.25% C.	16	5	0

Other Semi-products, etc.

Tin bars, 6-ton lots	12	2	6
Sheet bars, 6-ton lots	12	2	6
*Wire rods, soft basic	17	7	6
„ hard basic	21	2	6
„ free-cutting	20	2	6
„ acid	24	13	6

* Subject to rebate.

FINISHED STEEL

Usual district deliveries.

[A rebate of 15/- per ton for steel bars, section, plates, joists and hoops is obtainable in the home trade under certain conditions.]

	£	s.	d.
Plates, ship (N.E. Coast)	16	3	0
Boiler plts. (N.E. Coast)	17	0	0
Chequer plts. (N.E. Coast)	17	13	0
Angles, over 4 un. ins.	15	8	0
Tees, over 4 un. ins.	16	8	0
Joists, 3 in. × 3 in. and up	15	8	0
Rounds and squares, 3 in. to 5½ in.	16	8	0
Rounds under 3 in. to ¼ in. (untested)	17	12	0
Flats—over 5 in. wide	15	13	0
„ 5 in. wide and under	17	12	0
Rails, heavy, f.o.t.	14	10	0
Hoops	18	7	0
Black sheets, 24 g. (4-t. lots)	22	15	0
Galv. cor. shts. („)	26	2	6
Galv. flat shts. („)	26	12	6
Galv. fencing wire, 8g. plain	26	17	0

FINISHED IRON

	£	s.	d.
CROWN IRON:			
England and Wales	15	12	6
Scotland	15	12	6
Ireland, f.o.q.	16	5	0
No. 3 BARS:			
England and Wales	12	10	0
Scotland	13	12	6
Ireland, f.o.q.	13	2	6
No. 4 BARS:			
England and Wales	13	0	0
Scotland	13	17	6
Ireland, f.o.q.	13	12	6
STRIP:			
England and Wales	17	0	0
STAFFS MARKED BARS, f.o.t.	18	10	0

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated.

(September 9, 1941)

	Dols.
No. 2 foundry, Phila.	25.84
No. 2 foundry, Valley	24.00
No. 2 foundry, Birm.	20.38
Basic, Valley	23.50
Malleable, Valley	24.00
Grey forge, Valley	23.50
Ferro-mang., seaboard	120.00
O.-h. rails, h'y, at mill	40.00
Billets	34.00
Sheet bars	34.00
	Cents
Iron bars, Chicago	2.25
Steel bars	2.15
Tank plates	2.10
Beams, etc.	2.10
Wire rods	2.00
Skelp, grooved steel	1.90
Steel strip	2.10
Steel sheets	2.10
Sheets, galv., 24 g.	3.50
Wire nails	2.85
Plain wire	2.60
Tinplates, 100-lb. box	$5.00

COKE (at ovens)

Welsh foundry	50/–
„ furnace	36/9 to 38/9
Durham foundry	46/9
„ furnace	36/9
Scottish foundry	48/6 to 52/6
„ furnace	36/9

TINPLATES

I.C. cokes	20 × 14 per box	30/9
„	28 × 20 „	61/6
„	20 × 10 „	44/3
„	18¾ × 14 „	32/–
C.W.	20 × 14 „	28/6
„	28 × 20 „	57/–
„	20 × 10 „	42/3 to 42/9
„	18¾ × 14 „	30/– to 30/9

NON-FERROUS SCRAP

(Official Maximum Prices, per ton ex Works.)

	£	s.	d.
Bright untinned copper wire, in crucible form or in hanks	57	10	0
No. 1 copper wire	57	0	0
No. 2 copper wire	55	10	0
Copper firebox plates, cut up	57	10	0
Clean untinned copper, cut up	56	10	0
Brazierv copper	53	10	0
Q.F. process and shell-case brass, 70/30 quality, free from primers	49	0	0
Clean fired 303 S.A. cartridge cases	47	0	0
70/30 turnings, clean and baled	43	0	0
Brass swarf, clean, free from iron and commercially dry	34	10	0
New brass rod ends, 60/40 quality	38	10	0
Hot stampings and fuse metal, 60/40 quality	38	10	0
Admiralty gunmetal, 88-10-2, containing not more than ½ per cent. lead or 3 per cent. zinc, or less than 9½ per cent. tin	72	0	0

NEW BRASS TUBES, etc.

	Per lb.
Solid drawn tubes	13⅜d.
Brazed tubes	15⅛d.
Rods, drawn	11⅛d.
Rods, extd. or rlld.	8⅝d.
Sheets to 10 w.g.	10⅜d.
Wire	10⅜d.
Rolled metal	10d.
Yellow metal rods	8¾d.

COPPER TUBES, etc.

Solid drawn tubes	15d.
Brazed tubes	15d.
Wire	9¾d.

PHOSPHOR BRONZE

	Per lb. basis
Strip	13½d.
Sheet to 10 w.g.	14½d.
Wire	15⅝d.
Rods	15⅝d.
Tubes	21d.
Castings	17d.

Delivery 3 cwt. free.
10% phos. cop. £35 above B.S.
15% phos. cop. £40 above B.S.
Phosphor tin (5%) £40 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

AVERAGE MONTHLY PRICES OF UNMARKED BARS (SOUTH STAFFS)

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1906	7 0 0	7 5 0	7 5 0	7 5 0	6 17 6	6 15 0	6 12 6	6 10 0	6 10 0	6 12 6	6 16 3	7 3 9	6 17 8
1907	7 3 9	7 5 0	7 5 0	7 5 0	7 5 0	7 7 6	7 5 0	7 7 6	7 7 6	7 7 6	7 7 6	7 5 0	7 5 11
1908	7 2 6	7 0 0	7 0 0	7 0 0	6 15 0	6 7 6	6 5 0	6 2 6	6 2 6	6 2 6	6 2 6	6 0 0	6 10 0½
1909	6 0 0	6 0 0	6 0 0	5 17 6	6 0 0	6 0 0	6 0 0	5 17 6	6 0 0	6 2 6	6 2 6	5 17 6	5 19 9
1910	6 2 6	6 3 4½	6 7 6	6 7 6	6 7 6	6 7 6	6 6 6	6 5 0	6 5 0	6 5 0	6 5 0	6 5 0	6 5 7
1911	6 5 0	6 5 0	6 5 0	6 5 0	6 5 0	6 5 0	6 5 0	6 5 0	6 5 0	6 10 0	6 12 6	6 16 6	6 7 0
1912	6 18 9	7 1 10	7 2 6	7 8 9	7 18 0	8 0 7	8 2 6	8 3 6	8 5 0	8 6 3	8 7 6	8 8 9	7 17 0
1913	8 11 6	8 10 7½	8 10 0	8 8 1½	8 2 0	8 0 0	7 17 6	7 11 6	7 8 9	7 5 6	6 18 1½	6 17 6	7 16 9
1914	6 17 6	6 15 7½	6 12 6	6 10 0	6 10 0	6 10 0	6 10 0	7 11 10½	8 0 0	7 12 6	7 5 7½	7 6 3	7 1 0
1915	7 11 6	8 5 11	8 8 9	9 6 0	10 3 2	10 19 2	11 12 6	11 13 1½	11 13 9	11 14 3	12 1 10½	13 0 9	10 6 0½
1916	13 7 6	13 10 8	13 12 9½	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 3 9
1917	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0	13 15 0½
1918	13 15 0	13 17 3	13 17 6	13 17 6	13 17 6	13 17 6	13 17 6	14 15 0	14 15 0	14 15 0	14 15 0	14 15 0	14 4 5
1919	15 10 0	16 5 0	17 15 0	17 15 0	20 15 0	21 0 0	21 0 0	22 0 0	22 0 0	22 0 0	22 7 6	22 12 6	20 1 8
1920	24 7 6	24 10 0	25 10 0	27 10 0	29 5 0	31 0 0	31 10 0	31 10 0	31 10 0	31 10 0	31 10 0	29 7 6	29 1 8
1921	26 17 3	25 0 0	23 0 0	21 0 0	19 0 0	18 5 0	16 0 0	16 0 0	15 14 0	14 0 0	13 6 8	13 0 0	19 4 5½
1922	13 0 0	12 3 9	11 14 0	11 11 10½	11 5 0	11 3 6	11 2 6	11 5 0	10 17 2½	10 16 3	10 13 0	10 12 6	11 7 0½
1923	10 16 10½	11 3 1½	12 2 6	12 8 9	12 11 6	12 1 3	11 15 11½	11 15 0	11 15 0	11 15 0	12 13 6	12 8 3	11 18 10½
1924	12 9 6	12 10 0	12 10 0	12 15 7½	12 17 6	12 17 6	12 17 6	12 17 6	12 17 6	12 14 0	12 12 6	12 12 6	12 14 3½
1925	12 12 6	12 12 6	12 12 6	12 12 6	12 12 6	12 7 6	12 7 6	12 7 6	12 4 6	11 18 6	11 13 9	11 13 0	12 6 2
1926	11 7 9½	11 5 0	11 5 0	11 5 0	11 3 9	11 3 9	11 5 0	12 0 0	13 0 0	*	15 7 6	12 19 0	12 0 2
1927	12 6 3	12 2 6	11 14 0	11 0 0	10 18 9	10 13 6	10 12 6	10 5 0	9 16 0	9 15 0	9 13 9	9 12 9	10 14 2
1928	9 12 6	9 12 6	9 11 0	9 10 0	9 8 4	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 3 6	9 1 3	9 7 0
1929	9 0 0	9 2 6	9 5 7½	9 9 4½	9 10 0	9 17 6	10 2 6	10 2 6	10 2 6	10 0 6	10 3 9	10 5 7	9 15 2½
1930	10 7 6	10 7 6	10 7 6	10 6 10½	10 6 3	10 5 0	10 2 6	10 2 6	10 2 6	10 2 6	10 2 6	10 2 6	10 4 7½
1931	10 2 6	10 0 0	10 0 0	10 0 0	9 18 1½	9 17 6	9 17 6	9 17 6	9 17 6	9 17 6	9 17 6	9 16 10½	9 18 0½
1932	9 15 0	9 15 0	9 15 0	9 15 0	9 13 9	9 11 3	9 10 0	9 10 0	9 10 0	9 6 3	9 5 0	9 5 0	9 10 11½
1933	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0
1934	9 5 0	9 8 1½	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 11 6
1935	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6	9 12 6
1936	9 12 6	9 15 0	10 2 6	10 2 6	10 2 6	10 2 6	10 6 3	10 10 0	10 10 0	10 10 0	10 10 0	10 10 0	10 4 5½
1937	10 10 0	10 10 0	11 17 6	11 17 6	11 17 6	11 17 6	12 4 6	13 5 0	13 5 0	13 5 0	13 5 0	13 5 0	12 4 11½
1938	13 5 0	13 5 0	13 5 0	13 5 0	13 5 0	13 5 0	13 5 0	13 5 0	13 5 0	13 5 0	13 5 0	13 5 0	13 5 0
1939	12 5 0	12 5 0	12 5 0	12 5 0	12 5 0	12 5 0	12 5 0	12 5 0	12 5 0	12 5 0	12 15 0	12 15 0	12 6 8
1940	12 15 0	12 17 6	13 16 3	14 2 6	14 2 6	15 2 6	15 2 6	15 2 6	15 2 6	15 2 6	15 12 6	15 12 6	14 7 2½
1941	15 12 6	15 12 6	15 12 6	15 12 6	15 12 6	15 12 6	15 12 6	15 12 6	15 12 6	—	—	—	—

* No quotation available owing to strike.

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FOUNDRY MANAGER (38), practical and commercial experience, can take entire charge Malleable, Grey Foundries; specialist repetition. Midlands essential. Salary, results, £600.—Box 958, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

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Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, from whom full particulars can be obtained of this service.

FOUNDRY MANAGER, grey and high-duty irons. All types general engineering castings up to ten tons. Used to mechanised plant. Energetic, strict disciplinarian. Twenty-three years in charge. (415)

FOUNDRY FOREMAN or Manager. Wide experience repetition and jobbing castings to several tons, iron or steel. Technically trained. North of England preferred. (416)

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LONDON AGENT required to handle sales for Engineers' Ironfoundry.—Apply, Box 934, FOUNDRY TRADE JOURNAL, 3, Amersham Road, High Wycombe.

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A 12-in. Wadkin overhead planer, 18-in. underhand ditto, 4 circular saw benches, 7½-in. centre turning lathe, 2 pillar drilling machines, drum sander.

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Vats, benches, vices, shafting, electric motors, extractor fans, and duct, 4 double-headed grinders, Smithy, 7,000 maple roller blocks.

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200-lbs. and 80-lbs. Oil-fired Tilting Furnaces.
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36-in. Swing SLIDING-HEAD, BACK-GEARED PILLAR DRILLING AND TAPPING MACHINE (Cincinnatti), 1 5/8-in. dia spindle No. 5. M.T. Fast and loose pulley drive and 4-step cone drive, back geared.

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SAND MIXERS AND AERATORS.—The "Breakir" Centrifugal Machine is *THE* machine. Outputs 10 cwts. to 8 tons per hr.—W. BREALEY & CO., LTD., Station Works, Ecclesfield, Sheffield.

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